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11 alternatives to
Windows Defender



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Microsoft Copilot

AI

- Every app rated
- Create your own AI helpers
- Free alternatives



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Apple Vision Pro

Has the
gamble
paid off?

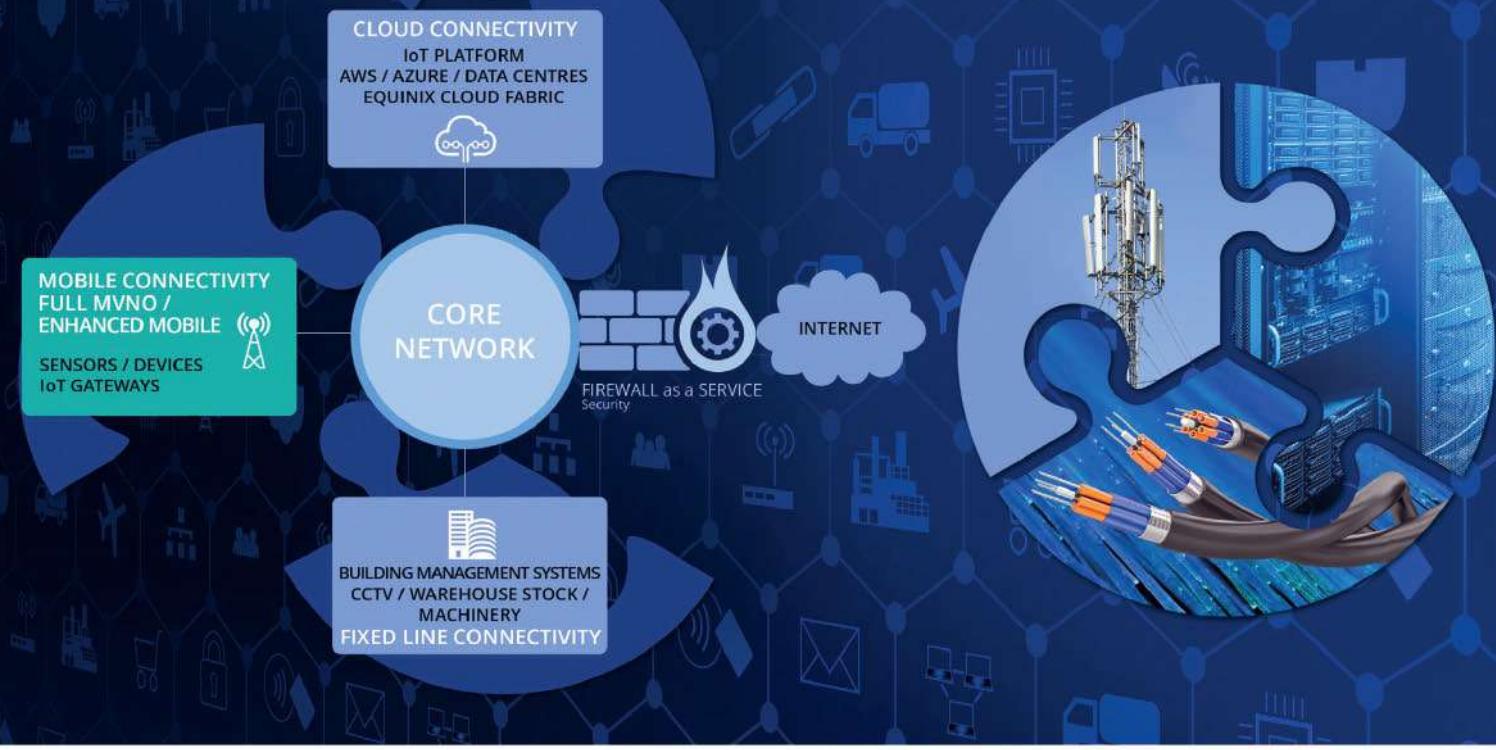


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HIGHLIGHTS THIS MONTH



REVIEW OF THE MONTH

Apple Vision Pro

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So here's the question: will the Vision Pro be the defining product of 2024, even the decade, or will it follow in the doomed footsteps of so many AR/VR/XR headsets before it? One of our US-based writers got his hands on (eyes on? head in?) Apple's \$3,499 spatial computing device, and he shares his views from p48. They're mostly positive, too. While we still await the Vision Pro's release in the UK, we wonder just how many people will be tempted to jet over to the States for an early sample...



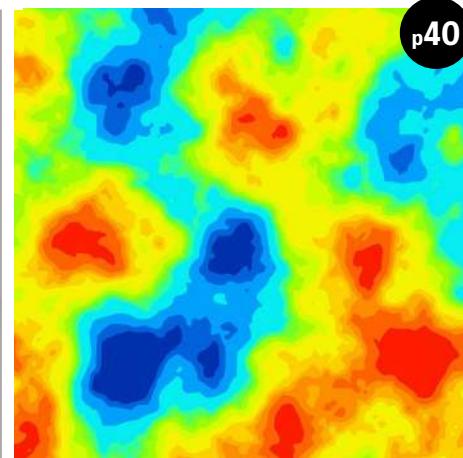
COPILOT OF THE MONTH

Microsoft has finally released a version of Copilot to boost Word, Excel, PowerPoint and more. We reveal what it's good for – and whether it's worth the money – from p26.



PREDICTION OF THE MONTH

You can currently bag a gigabit fibre bargain thanks to the rise of numerous challengers to BT and Virgin. But is it a smart long-time move? Barry Collins investigates.



DRAWING OF THE MONTH

They say a picture is worth a thousand words, but we think that Wi-Fi heatmaps are probably worth double that if done right. And we reveal exactly how on p40.

REBIRTH OF THE MONTH

SAM Coupé

p123

This is a 1980s 8-bit computer with a difference: the Coupé was trying to outgun the 16-bit Amiga and the Atari 520ST. It failed to make a commercial impact at the time, but has now begun a second, more successful life.



THE LABS IN ONE NUMBER

Why pay good money for security suites when the free antivirus provided by Microsoft, AVG and others protects you just as well? We find out as we put 11 paid-for alternatives to the test.

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GIGABIT FIBRE BROADBAND: SHOULD YOU UPGRADE?

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With one foot in the past and one eye on the future, the SAM Coupé may yet go down in history as a legendary computer. David Crookes uncovers its story.



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SECURITY SUITES VS FREE ANTIVIRUS

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Can you get away with not paying for your antivirus software? We investigate 11 alternatives to Windows Defender and round up the best of the free offerings to find out.

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**Futures****126 Will working with robots make us lazy?**

Research has suggested we slack off when teamed with a robot – not because Roombas are vacuuming our houses, but because humans have a habit of taking it easier when sharing tasks. Nicole Kobia picks up the slack to find out more.



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Copilot Pro has landed, so why can't it write this column for me?

Oh dear! Oh dear! I shall be too late!" So said the White Rabbit in *Alice's Adventures in Wonderland*, and I can only assume that Lewis Carroll had access to both a time machine and mind-reading equipment, because that's precisely what I feel every month at this point. The magazine has to go to press! There's too much to do! If only some kind of magical creature could help!

Well, that creature has arrived, and it is neither furry, nor white, nor the wearer of a waistcoat. Of course, I'm talking about AI. I currently subscribe to Copilot Pro and Google's Gemini equivalent, and in theory they could certainly whip up 600 words for this column; all I would need to do, like a certain mouse in *Fantasia* if I may jump creative genres, is give them direction. A tidy up here, an edit there, job done. Anyone for a pint?

Sadly, we haven't reached that point. Except, no, it's not sad at all. If you read our guide to Copilot for Office this month (see p26), and we include at least three jokes to make it worth your while, then you will get a clear idea of what AI is good for and what it's rubbish at. I would summarise it thus: that AI summarises

mush. The mush of our meetings, our emails, our documents and spreadsheets. Mush that we no longer need to attend, read or even write. Hallelujah! Anyone for a pint?

Okay, not quite yet. Because the other conclusion you will rapidly draw from the article is that AI can't be trusted. It's like one of those employees – if you don't know one of those employees, you are one of those employees – who has an irritating habit of misunderstanding something, jumping to the wrong conclusion, and then repeating it ad nauseam. AI often acts like an amplified idiot rather than artificial intelligence, as it's always so darn confident about things. You can't give AI free rein, in the same way you wouldn't let that employee run the company. It needs oversight.

At this point, you may be wondering why I'm paying almost £40 per month for two services that I don't trust. Services that can't even write a column for me. But there are reasons, including a few surprises. One is that Copilot's generative AI art service – specifically, OpenAI's DALL-E, which powers Microsoft Designer – is rather brilliant. Now that I'm getting to grips with prompts, it produces graphics that I can use

professionally. For the first time in my life, I can turn ideas in my head into something resembling art.

In truth, that has been the only transformative aspect of Copilot so far for me. I occasionally use it in Word, to tidy up a sentence, and as a fail-safe: having written something, I sometimes check if there's anything I've missed by getting the AI to auto-generate its own outline.

Another reason I keep subscribing is that I know these services are going to improve. It's always a mistake to have a vitriolic reaction to the first generation of anything and think they're going to stay that way. Just look at bendable phones; when Huawei showed me its first-generation Mate X five years ago, it wouldn't even let me touch the phone, such was its fragility. This month I review the Honor Magic V2 (see p70) and it's light years ahead.

Will I be saying the same thing about the fifth-generation Lenovo ThinkPad X1 Fold 16 (see p58)? Well, that's a question for the pub, and if there's something that Word is good at it's telling me word counts. 600 on the dot. Let's hope I haven't left it too late.

Tim Danton
Editor-in-chief

CONTRIBUTORS



Darien Graham-Smith
This month we gave Darien one task: to explain how to turn that vague feeling we all have about Wi-Fi dead spots in our homes and offices into a fully fledged heatmap. See p40.



Barry Collins
You've almost certainly been tempted by a fibre broadband deal from an "altnet" provider. Barry digs beneath the headline prices to see if you should buy from p34.



Ian Betteridge
One of our trio of Microsoft AI testers this month, the former editor of *MacUser* delivers his verdict on Copilot Pro for Word, Excel, Outlook and PowerPoint from p26.



Nicole Kobia
A study claims people become lazy when working with robots, which could have ramifications for our AI-assisted future if true. But Nicole has her doubts, as you'll discover on p126.

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- On p25, you'll find out what our readers think about Microsoft Copilot AI for Office apps – and we cover this topic fully from p26. But we wanted to know: have our contributors tried Copilot Pro yet and what do they think of it?
- "I'll continue to pay £19 per month for Copilot Pro as it can indeed save time in Word and help me do new things in Excel (although I hate the new Outlook). The biggest surprise: how useful I've found Designer to create striking images for web articles."
- "I'm not an Office user and am snuggled up with Google's Gemini, which is better than your Copilot so yah boo sucks. Just waiting for Gemini to do pictures here (everywhere but UK and Europe at present)."
- "Call me Copilot-curious. The price feels steep when the base Office suite costs only a fiver, but if Microsoft's AI can save me just a few hours' work each month then it's clearly worth it. I don't want to rely on AI tools too much, though – otherwise Tim might well start to wonder what he's paying me for!"
- "I tried it, but Microsoft hasn't designed to bring it to Mac, and I'd rather chew broken glass than use the web apps, so it was the quickest refund in tech history."
- "I haven't tried it yet because £19 a month isn't cheap – I'll wait and see if anyone's using any of the features in three months, and then we'll see."
- "A firm 'don't care' right now, but then I made the same mistake about social media and air fryers in years gone by, so I could well love it by this time next year."
- "All the Copilot stuff about unlocking my creative potential rings a bit hollow: I unlocked that in 1985 or so on a cast metal Olivetti typewriter, so I'm really not in the target audience."
- "No appeal here. And given the bait-and-switch nature of tech subscriptions, I'm not falling for the (frankly unattractive) £19 carrot to join 'Club Sucker' who'll need to pay £25 next year so their AI responses aren't sprayed with adverts."
- "Haven't tried it and I'm not sure I want to deploy it across my team, as that would be £190 per month (uplift to ten E3 licences)."
- "Not tried it, not sure I need it, and at that price I'm unlikely to be finding out."



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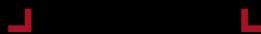
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Briefing

Background and analysis on all the important news stories

Apple grudgingly waters down iOS rules

Third-party app stores arrive on the iPhone... but not in Brexit Britain

Sometimes in life, you have to do something you don't want to do. And this is true especially if the person telling you what to do is the all-powerful EU tech regulators – even if you're as omnipotent as Apple.

Last year, a major new law came into force across the EU that was designed to rein in the power of the tech titans by designating companies such as Apple, Microsoft and Meta as “core platform services”, conferring on them a new set of obligations.

Now we're starting to see what that looks like in practice, as Apple has grudgingly announced a raft of changes to the way that iOS works, in response to the EU's desire for more competition on our phones.

For example, web browsers on iPhone will no longer be limited to Apple's own WebKit rendering engine, which means that third-party browsers – and not only third-party wrappers for WebKit – could soon come to iOS for the first time.

Perhaps more significant for most iPhone owners are the changes to payments and the App Store. Apple will soon be allowing third-party payment apps to take advantage of the iPhone's NFC chip, meaning that European users could be making payments in shops without having to go through Apple Pay, denying Apple a cut of the revenue.

And as for the App Store, the Digital Markets Act (DMA) essentially means that Apple's monopoly over how apps can be installed on iPhones is over, as third-party app stores will be permitted. (You can read Jon Honeyball's take on this from p110 – Ed.) Such a thing has been available on Android for many years, where users have long been able to download apps from stores provided by companies such as Amazon and Epic Games instead of Google.

“Malicious compliance”

Unsurprisingly, Apple isn't happy. In announcing the changes,

ABOVE iPhone users in the EU will soon be able to access third-party app stores

a press release on Apple's website warned that “the new options for processing payments and downloading apps on iOS open new avenues for malware, fraud and scams, illicit and harmful content, and other privacy and security threats”.

And in executing the changes, Apple is essentially trying to give as little ground as possible, to the point where Epic Games' CEO Tim Sweeney, a well-known Apple detractor, characterises Apple's response to the changes as form of “malicious compliance”.

This is because even though it will soon be possible for Europeans to install iOS apps from outside

of Apple's ecosystem, apps in Europe will not be completely free from Apple's interference. Apps installed

“Apple's monopoly over how apps can be installed on iPhones is over, as third-party app stores will be permitted”

from third-party stores will still need to be “notarised” by Apple – which is essentially being processed through Apple’s malware-detection system. And perhaps more provocatively, Apple is also insisting on charging a “core platform fee” of 50 cents for apps downloaded from third-party stores, for any apps with more than a million downloads.

In a further sign of just how tightly Apple is keeping its response to the new, money-losing rules, *PC Pro* has confirmed that the new rules will very strictly apply to only the 27 members of the European Union, whereas iOS on British iPhones will remain locked down. However, it’s likely that many British developers and companies working across the continent will be affected by the changes.

“People have referred to it as a middle finger to the EU, I don’t think that’s inaccurate,” said Gene Burrus, global policy counsel at the Coalition for App Fairness, a lobbying group that represents companies including Epic, Spotify, Tile and Proton.

“I think it will lead to EU enforcement action against Apple, quite frankly,” said Burrus. “I mean, it is not compliant with the DMA.”

Burrus likens Apple’s behaviour to that of Microsoft, which two decades ago similarly found itself in the European Commission’s crosshairs – with the EU ultimately forcing Bill Gates to separate Windows from bundled software such as Windows Media Player.

“Ironically, it was Apple itself who took full advantage of that situation when it was able to put iTunes on Windows 20 years ago,” said Burrus of a decision which boosted sales of iPods. “They are foreclosing a similar opportunity for independent developers on iOS at this point.”

But isn’t it true that Apple’s security model is undermined by the DMA? “You need to look only as far as the Mac,” said Burrus. “It is secure and they allow you to download apps from the internet. There isn’t a technical reason why you can’t have downloaded secure apps or signed apps or certified apps from the internet.”

Burrus believes the EU needs to be tougher on Apple, because the company is effectively the single major gatekeeper to the internet. “If that’s what Microsoft was allowed to do to Apple in 2005, there would be no Apple today,” said Burrus. “You’d be listening to music on your Zune... and you’d be using a Windows Phone.”

“I think it will lead to EU enforcement action against Apple. It is not compliant with the DMA”

AI uncovers Roman secrets

Two-thousand-year-old scrolls have been transcribed by a team working on Discord

79AD was not a great time to be living in the ancient Roman town of Herculaneum. It was in that year that the nearby volcano Vesuvius erupted, quickly burying the town in volcanic debris, freezing it in time along with nearby Pompeii.

Two thousand years on and Herculaneum today is a popular tourist attraction, with astonishingly well-preserved architecture and vivid mosaics for visitors to enjoy. But one secret has remained: the contents of hundreds of scrolls that were buried and cooked with the eruption.

Despite being some of the few remaining examples of writing from the Roman era, the scrolls are simply too fragile to unravel. So, since they were first rediscovered in 1750, their contents have been a mystery. At least, they were until a bunch of computer scientists in a Discord chat got to work on it.

Back in 2019, Kentucky professor Brent Seales scanned a number of the scrolls at the Diamond Synchrotron – an enormous ring-shaped x-ray facility in Oxfordshire – and then last year Silicon Valley stepped in to decipher the scans.

A group led by former GitHub CEO Nat Friedman created the “Vesuvius

Challenge” and offered a \$700,000 bounty to the first person or team to take the scans and successfully unravel the text of 5% of one of the scrolls, the hope being that the technology the winners developed could then be used to decipher the other 800 scrolls.

In late January, three young volunteer researchers – Youssef Nader, Luke Farritor and Julian Schilliger, who collaborated together on the project’s official Discord – were awarded the jackpot after successfully uncovering a significant chunk of text.

They started by turning the X-ray scans into a 3D model, and then segmented the scans into individual pages by writing an AI model that would virtually uncrumple the papyrus. From this, they then created a separate AI model to detect signs of ink so that they could uncover the hidden characters within. The key for spotting ink appears to be a hidden “crackle pattern”, where the ink on the page had impacted the papyrus below. The researchers were able to train their model to specifically look for such patterns.

So what did the scroll actually say? It turns out that it contains a Roman author’s philosophical musings about the nature of pleasure and its relationship with scarcity. But we’ll have to wait until the rest of the scroll has been uncovered to see if it really is a page-turner.



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Benefits of Bitcoin

The UK is pressing ahead with a digital pound. **James O'Malley** investigates the potential upsides of a digital currency

Whether you're a believer or not, it's hard to deny that since the explosion of Bitcoin, Ethereum and other cryptocurrencies, we're living through an era of significant financial innovation. From distributed ledgers to smart contracts and NFTs, crypto has pioneered new ways of doing business – for better or for worse.

That's why the traditional banking system is worried. And it's why central banks are starting to explore what their own Central Bank Digital Currencies (CBDCs) might look like. That includes the Bank of England (BoE), which recently published its thoughts on how to create Britain's own "digital pound".

It might sound like little more than press-release posturing, but there could be considerable upsides to Britain developing its own digital currency. And big risks if we don't.

■ On the defence

As a starting premise, CBDCs have a defensive purpose – because whether central banks like it or not, digital currencies aren't going away. It isn't just crypto that's threatening the BoE's monopoly on money, either; other countries are experimenting with digital currencies, too.

"This is a really important once-in-a-generation shift in money," said David Birch, a fintech advisor and author of a book called *The Currency Cold War*. "It's important to the future of UK PLC to get it right."

He warns against Britain jumping in too quickly, as other countries including India have arguably done. But he does worry that if Britain doesn't develop its own digital currency it could lose standing as a major financial power.

"On the political side, you've got issues of national sovereignty and monetary policy," said Birch. "Obviously it would be difficult to run a country if everybody in the country was using US digital dollars, because they were easier to use and because it was cheaper than mucking about with pounds. So, we don't want that to happen."

There are plenty of positive reasons to develop a digital pound, too. He points to the role a such a currency could play in terms of equity and inclusion – because if we can have digital wallets that aren't connected to bank accounts, it will enable the

2.1% of UK adults who don't have bank accounts to make payments in a world where cash is seldom used any more.

"Then you've got the purely technological [reasons], which fall into two categories," explained Birch. "There's the resilience of the infrastructure, where I personally think CBDC is critical, and then you've got the issue of innovation."

“This is a really important once-in-a-generation shift in money. It’s important to the future of UK PLC to get it right”

Facebook's lasting impact

Why are banks interested in developing digital currencies? "You can draw a straight line in the evolution from Bitcoin to CBDC, even though the two are like chalk and cheese," said Jannah Patchay of the Digital Pound Foundation.

The flashpoint was Facebook's 2017 decision to launch its own cryptocurrency called Libra, which elevated the blockchain technology from a Silicon Valley curiosity to a serious threat to the entire global financial system.

"This immediately caused a massive panic for central banks because, with Facebook's then reach of 2.3 billion users, if everyone started using this alternative currency it was a huge threat to the monetary sovereignty of most of the world's countries," she said.

"So central banks started doing two things. First of all, they started looking at how they could regulate the hell out of these 'stable coins', as they were called. And second, they started looking at

what they could do to remain competitive in this environment where clearly the form of money that people were looking to use would change."

As a result of the regulatory scrutiny the project attracted, it fell apart almost as quickly as it appeared, with Facebook losing partners such as PayPal and Mastercard as the screws were turned. The experiment was finally shuttered in 2019, before anything had even launched. Nevertheless, it might still change the global finance system for good.

■ New products and services

The final design of the system hasn't yet been determined, but it's likely that end users will not interact directly with the Bank of England. There won't be a Bitcoin app made by the government that we have to download to make payments. Instead, it will act as the technology that undergirds our banking and digital wallet apps.

But once it's up and running, we may start to notice new financial products and services emerge that are only possible because of the new plumbing. "Ten pound notes don't have APIs, but digital currency will," said Birch. "By creating an open permissionless platform, people can access and use [it] to build new





applications, products and services that exchange value, without involving credit risk and banks."

He added: "I'm sure there are kids in basements who will build some cool stuff on it."

We can already imagine new fintech tools by looking at the crypto business. For example, there are smart contracts (or "programmability") built into currencies such as Ethereum that a digital pound could also take advantage of.

"The Bank has said in its proposals for a digital pound that the money itself will not be programmable, [but] the payment providers around it will be able to have a level of programmability around how funds are released," said Jannah Patchay, executive director and policy lead at the Digital Pound Foundation, a forum supporting the creation of Britain's own digital currency.

This could benefit consumers. At present, when we buy things online we have to make a payment and hope that the merchant will actually send the goods. But with digital money, you could conceivably use a programmable "smart contract" to hold the money in escrow, which is only released to the seller once the courier has delivered the parcel to your door.

Similarly, digital money could make it possible to pay taxes at the point of purchase, with HMRC receiving their cut of the sale instantaneously, instead of at the end of the quarter. "Not everyone is quite thrilled about that sort of thing," said Patchay.

But there is another intriguing use-case Patchay points to that we've previously seen with cryptocurrency – that, unlike physical cash, digital money can be divided up infinitely. "Right now, the smallest denomination that we have is a penny," she explained, pointing to how this could transform payment for digital content.

"It's annoying when somebody sends me an article from *The Times* or *Telegraph* and I can't read it because it's behind a paywall," she said. "But if I had the ability to make fractional payments of a fraction of a pence, I could consume a broader range of content, and also the content creators would be rewarded."

However, the best reasons for creating a digital currency are those that nobody has thought of yet, which will only become apparent once such a system is created. "I will partly be very disappointed if I can come up with

ABOVE A British digital currency could revolutionise how we use money

following the distributed model, where all transactions are publicly visible on a blockchain.

This is because of a perceived flaw with the privacy of the blockchain system. "If your [wallet] address was eventually published on the internet, I could then see every payment you've ever made or received, which is far from the privacy goals that we've obviously [intended] to do on the digital pound," said Russell.

Instead, he hopes privacy will be maintained by other means. "We need this commitment to be strong and also believed, so we are investigating both legal – with the commitment to primary legislation – and also technological solutions as well," he said.

It's important that the government is not seen to be controlling our finances, too. "There's going to be primary legislation that sets out clearly that neither the central bank nor the government will have access to user data or transaction data," said Patchay, adding that the intention is to replicate the same protections we have on our traditional bank accounts today.

"Law enforcement can't just walk into a commercial bank... and say, 'give us your customer data,'" she added. "That has to be subject to a search warrant. It needs a legal justification for why they need a certain type of data,

and even then, what the bank gives them is limited."

It could ultimately be this privacy aspect that determines whether Bitcoin succeeds or fails. "If we do not get privacy right... we fully appreciate that this will not get off the ground," said Russell.

The consultation process is still ongoing, and we're some distance from anything concrete. The design phase of the programme is due to continue until at least next year and the currency is unlikely to launch before 2030. But this leisurely pace may not be entirely a bad thing – as long as we get there eventually.

"I don't want the Bank of England to rush [but] I do want the Bank of England to do it," said Birch. "I don't want to end up in a situation downstream where it costs more to do business in the UK, or with the UK, because we don't have digital currency."

the best use case for the digital pounds," said Danny Russell, head of digital currency technology at the Bank of England.

■ Private payments

There are still lots of unanswered questions about the digital pound, and the BoE has many decisions to make about the final design of the system. But it does seem to have settled on one significant architectural choice that puts it at odds with the philosophy behind crypto, and that is to go with a centralised ledger. This means that it would be the BoE itself clearing payments and storing the details of transactions – instead of

“Digital money could make it possible to pay taxes at the point of purchase, with HMRC receiving their cut of the sale instantaneously”

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The A-List



The best products on the market, as picked by our editors



PREMIUM LAPTOPS

Apple MacBook Pro 16in (2023)

M3 power from £1,699
from apple.com/uk

The M3 chips give the already brilliant MacBook Pro series a boost in games with no sacrifices elsewhere, so power users who are happy with Apple must grapple with the big decisions: which M3 chip, which size of screen, and how much RAM and storage? **REVIEW** Issue 352, p46



ALTERNATIVES

Apple MacBook Air 15in
It's no MacBook Pro, but with an 8-core M2 chip the 15in MacBook Air offers solid performance and a spacious, good-looking display for a great price. From £1,399 from apple.com/uk **REVIEW** Issue 347, p60

NEW ENTRY

HP Spectre x360 14 (2024)
An Intel Core Ultra 7 processor means that this is a fast 2-in-1 as well as being beautifully designed, with a sumptuous screen and excellent battery life. £1,899 from hp.com/uk **REVIEW** Issue 355, p62

NEW ENTRY

Samsung Galaxy Book4 Pro 16in
This super-sleek laptop packs amazing battery life thanks in part to Intel's Core Ultra 7 processor, while the 16in OLED panel is a joy to behold. £1,699 from samsung.com/uk **REVIEW** Issue 355, p64

GAMING LAPTOPS

Asus ROG Zephyrus M16 (2023)

Core i9/4090 for £4,100

from rog.asus.com/uk

Asus includes everything in this gaming laptop, including a personalisable lid via a matrix of lights. And a 16in AMOLED screen, 2TB SSD and cutting-edge components. If the £4.1K price puts you off, Overclockers UK sells an RTX 4080 version with a plain lid for £3,300. **REVIEW** Issue 343, p50



ALTERNATIVES

Lenovo Legion 5i Pro (16in)
A great-value gaming laptop that's extracts the most from its powerful components. We love the keyboard, too. **Part code** 82RF002LUK, £2,000 **from** lenovo.com/gb **REVIEW** Issue 337, p61

Lenovo Legion 9i Gen 8 (16in Intel)
The liquid-cooling system may be only for bragging rights, but this slim laptop delivers the goods with a superb 16in mini-LED screen. **RTX 4090, £4,180 inc VAT** from lenovo.com **REVIEW** Issue 353, p58

Razer Blade 18
A great advert for 18in gaming laptops, the Blade 18 partners a Core i9-13950HX with RTX 40-series graphics in a stunning, slim design. **From £2,900 from** razer.com/gb-en **REVIEW** Issue 343, p52

BUSINESS LAPTOPS

Lenovo ThinkPad X1 Carbon Gen 11

Business class from £1,583 exc VAT
from lenovo.com

Fight past Lenovo's opaque pricing – another flash sale, really? – and you'll find a slim, powerful and long-lasting laptop for a competitive price. With a wide range of available configurations, all based on Intel's 13th generation Core chips, this is our top choice for all sizes of business. **REVIEW** Issue 350, p85



Dell Latitude 7340

This 1.1kg laptop offers terrific battery life and, if you choose the better non-touchscreen (look for 400 nits of brightness in the specs) it's a joy to use, too. **From £1,109 exc VAT from** dell.co.uk **REVIEW** Issue 350, p82

Acer TravelMate P6 (TMP614-53)

The all-new TravelMate P6 benefits from a 14in OLED screen with a 2,880 x 1,800 resolution, plus a very generous spec for the price. It's simply great value. **£1,209 exc VAT from** acer.co.uk **REVIEW** Issue 350, p80

HP Dragonfly G4

It's not the fastest machine you can buy, but otherwise this 1kg masterpiece is as close as you're going to get to the perfect business laptop for executives. **From £1,380 exc VAT from** hp.com **REVIEW** Issue 352, p58

EVERYDAY LAPTOPS

Honor MagicBook 16 X (2023)

Full metal jacket for £700

from hihonor.com

A high-quality all-metal chassis marks the MagicBook 16 X 2023 out from the budget laptop crowd, and it's packed with good-quality (albeit not top-quality) components, from a 12th gen Core i5 chip to a 1,920 x 1,200 16in IPS panel. **REVIEW** Issue 348, p59



ASUS VIVOBOK S 15 OLED

The Core i5 version of this 1.7kg laptop offers amazing quality for under a grand, including a high-quality 15.6in OLED display. **From £949 from** pcpro.link/347asus2 **REVIEW** Issue 347, p85

Microsoft Surface Laptop Go2

The Laptop Go 2 won our recent group test of affordable laptops thanks to its high-quality 12.5in screen, 1.1kg weight and sleek design. **£555 from** microsoft.co.uk **REVIEW** Issue 347, p89

MSI Prestige 15

Not the most cultured laptop, but great value considering the connectivity, 15in screen, fast specs and a GeForce RTX 3050 GPU (part code A12UC-034UK). **£849 from** laptopoutlet.co.uk **REVIEW** Issue 347, p93

CHROMEBOOKS**Acer Chromebook Plus 515**

Double power for £400
from currys.co.uk

An excellent debut for Google's Chromebook Plus initiative, with Intel's Core i3-1315U CPU providing the power, with 8GB of RAM and 256GB of storage for company. The chassis is well built, and the 15.6in screen is good for the price.

REVIEW Issue 351, p44

**Acer Chromebook Vero 514**

Acer combines its eco-conscious Vero brand with Chrome OS to great effect in this surprisingly powerful 14in Chromebook. With a 12th generation Intel Core i5 processor, 8GB of RAM and a 256GB SSD, plus Chrome OS updates until 2030, it's a fine long-term investment that helps cut down on electronic waste.

£599 from currys.co.uk
REVIEW Issue 340, p54

HP Elite Dragonfly Chromebook

This is quite simply the best business Chromebook around, although at the time of writing we're waiting for units to hit the market. Build quality is stunning, as is this 13.5in convertible's 1.3kg weight.
From £1,000 from hp.co.uk.
REVIEW Issue 337, p86

EVERYDAY PCs

NEW ENTRY

Apple Mac mini (2023)

M2 masterpiece from £649
from apple.com/uk



The outside remains the same, but this simple yet effective update to the Mac mini introduces the M2 and M2 Pro processors with predictable effect. The entry-level price quickly rises once you start upgrading – moving from 8GB to 16GB costs £200, as does doubling the base storage from 256GB to 512GB – but there's enough power here to last you for years.

REVIEW Issue 343, p60

Intel NUC Pro 13

If you don't need discrete graphics then Intel's mini PCs are a fantastic choice, being easy to upgrade, low on energy consumption and more than powerful enough to cope with Windows applications – despite being little larger than a coffee coaster.
Barebones, from £350; full PCs, from £600, from scan.co.uk
REVIEW Issue 345, p48

PCSpecialist Fusion Elite P

A promising debut for AMD's Ryzen 8600G processor, this quiet-running, power-efficient system packs in lots of performance considering it costs so little. And a slot sits empty for a future graphics card upgrade should the built-in graphics prove insufficient for your gaming needs. **£649 from pc specialist.co.uk/reviews**
REVIEW Issue 355, p54

ENTHUSIAST PCs**Chillblast Apex Ryzen 9 RTX 4090 Gaming PC**

7950X3D and RTX 4090 for £4,400
from chillblast.com

A brilliant choice if you're looking for easy expansion tomorrow coupled with cutting-edge gaming with high-quality components today.

REVIEW Issue 347, p52

**HP Omen 45L (2023)**

We tested the top-end 45L with a Core i9-13900K, GeForce RTX 4090 graphics and 64GB of RAM, and it doesn't come cheap. Switch to the Core i7/RTX 4070 Ti version, however, and the price almost halves without losing any of the superb design and build quality. **£4,800 from hp.co.uk**
REVIEW Issue 347, p50

Alienware Aurora R16

An understated yet stylish gaming PC that runs quietly even when pushed. This rig has power where it counts, mixing Intel's latest CPUs with Nvidia's RTX GPUs. Choose an RTX 4070 or higher to benefit from the glass side and liquid cooling, which lifts it above rivals. **From £1,349 from dell.co.uk**
REVIEW Issue 349, p54

ALL-IN-ONE PCs**HP Envy 34 All-in-One**

£2,099 widescreen wonder
from hp.com

Built around a high-quality 34in widescreen – which is perfect for viewing two windows side by side thanks to its 21:9 aspect ratio – this also comes with Nvidia RTX 3060 graphics. We're big fans of the magnetic 16-megapixel camera, too.

REVIEW Issue 335, p46

**Dell Inspiron 24 All-in-One**

Despite being built to hit a price point, the Inspiron 24 All-in-One manages to look classy, include a good-quality, 1,920 x 1,080 24in panel and have enough power to breeze through a typical day's tasks. It even packs mod cons such as a 720p webcam. Superb value for money.
From £599 from dell.co.uk
REVIEW Issue 350, p47

Apple iMac 24in (M3)

The iconic design remains the same, but the plain M3 chip inside the revamped iMac 24in is a revelation compared to the previous M1 version. The downside is that the base configuration includes a stingy 8GB of memory and a 256GB SSD.
From £1,399 from apple.com/uk
REVIEW Issue 352, p52

CREATIVE WORKSTATIONS**Scan 3XS GWP TR Ada**

Record breaker for £14,167 exc VAT
from scan.co.uk

A 64-core Ryzen Threadripper 7980X blows everything that went before out of the water with multithreaded tasks, while Nvidia's RTX 6000 Ada graphics dominates for viewport acceleration and GPU rendering. Even storage throughput is unparalleled. With a striking chassis and brilliant build quality, you'll want for nothing.

REVIEW Issue 353, p52

**Armari Magnetar MC16R7**

A strikingly fast workstation for the money, with Armari's customised liquid cooling extracting the most from an AMD Ryzen 9 7950X. With 64GB of DDR5 RAM and AMD's Radeon Pro W7800 in support, this is a fantastic value machine.
£3,758 exc VAT from armari.com
REVIEW Issue 348, p84

PCSpecialist Onyx Pro

Even in a creative workstation, it makes a lot of sense to include Nvidia's consumer graphics due to its core-per-buck. Here, an Nvidia RTX 4090 partners with a Core i9-13900K and an incredible 192GB of RAM to tremendous effect. **£3,750 exc VAT from pc specialist.co.uk/reviews**
REVIEW Issue 348, p86



TABLETS

Apple iPad Pro 12.9in

Simply the best, from £1,249

[from apple.com/uk](http://apple.com/uk)

The best tablet out there thanks to Apple's powerful M2 chip, even if the upgrade prices sting in their usual fashion. In return you'll get a workhorse during the day (especially with the optional Magic Keyboard) and a brilliant entertainer at night.

REVIEW Issue 352, p84



Samsung Galaxy Tab S9 Ultra

The best of the big-screen Android tablets, with the bonus of Samsung's DeX environment if you want to use it as a desktop replacement, while One UI lets you manage multiple windows and multitask between them. The 14.6in AMOLED screen is superb, too.

From £1,199 from samsung.com

REVIEW Issue 352, p87

OnePlus Pad

The OnePlus fully justified its place in our luxury tablet Labs thanks to its outstanding build quality, slick performance and stunning 17-hour battery life. It's the best Android option outside of Samsung's Galaxy Tabs – and it won't do nearly so much damage to your wallet.

£449 from oneplus.com

REVIEW Issue 352, p86

EVERYDAY PHONES

NEW ENTRY

Motorola Moto G54 5G

Great looker for £180

[from johnlewis.com](http://johnlewis.com)

The 6.5in 120Hz IPS display is the G54's standout feature, but it improves on the previous generation in numerous ways while being even cheaper. It's faster, looks better, takes great photos and battery life is strong. You won't find better for less than £200.

REVIEW Issue 355, p77



Google Pixel 7a

A phone that begs the question: why spend £150 more for the Pixel 7? With few compromises on the Pixel 7a – it uses the same processor and cameras and the only notable change is a smaller screen – this is the new mainstream pick for Google phone fans.

128GB, £449 from store.google.com

REVIEW Issue 346, p68

Motorola Edge 30 Neo

This stylish and compact smartphone – reflected by a small-ish 4,200mAh battery – includes a gorgeous 6.3in OLED screen, nippy Snapdragon processor and a decent pair of cameras for a great price.

£300 from motorola.co.uk

REVIEW Issue 348, p73

PREMIUM PHONES

Samsung Galaxy S24 Ultra

AI cleverness from £1,249

[from samsung.com/uk](http://samsung.com/uk)

The undeniably high price gets you a bunch of AI tools that will genuinely save you time (and money). While we miss the 10x optical zoom of the S23 Ultra, the 5x zoom camera and supporting cast capture brilliant images, while the S Pen is always on hand to scrawl notes and pictures.

REVIEW Issue 354, p58



Google Pixel 8

It's not a huge step up from the Pixel 7, but the added AI features are genuinely useful and it benefits from a handful of upgrades, too – including a 120Hz screen and the new Tensor G3 processor. If you don't mind the lack of optical zoom, it's a great buy for the price. **128GB, £699 from store.google.com**

REVIEW Issue 351, p72

Samsung Galaxy Z Flip5

While the Galaxy Z Fold5 has its undoubted attractions, the Flip5 pips it onto this A List slot thanks to it being £700 cheaper and through the usefulness of the expanded front display. It's also IP68 rated and packs a stellar chip, beating rival flip phones. **From £1,049 from samsung.com/uk**

REVIEW Issue 349, p70

EVERYDAY MONITORS

Lenovo ThinkVision P27u-20

4K Thunderbolt, £550

[from lenovo.com](http://lenovo.com)

We reviewed this when it cost £470, but even at £550 it's a superb buy. It's a top-quality 27in panel with a 4K resolution, and it packs superb connectivity, including Thunderbolt 4.

REVIEW Issue 344, p89



AOC Q27P3CW

If you can't afford the ThinkVision P27u-20 then this 27in USB-C docking monitor, complete with solid image quality and a 1440p resolution, offers unmatched value at a shade over £300. It even includes a webcam that supports Windows Hello.

£310 from box.co.uk

REVIEW Issue 344, p83

Iiyama ProLite XCB3494WQSN

Curved 34in monitors proved a popular choice in our Labs, and although it had tough competition from the HP E34m G4 this Iiyama steals a spot on our A List due to Iiyama's twin focus on value and quality panels. There's even gaming potential. **£400 from scan.co.uk**

REVIEW Issue 344, p88

PROFESSIONAL MONITORS

Eizo ColorEdge CG319X

Creative masterclass, £3,960

[from wexphotovideo.com](http://wexphotovideo.com)

As the price indicates, this monitor is for heavyweight creatives who demand the best in every discipline: HDR video editing, print layouts, professional photography and more besides. With superb coverage and accuracy across all spaces, plus a built-in calibrator, it justifies the investment.

REVIEW Issue 327, p81



BenQ PD2725U

By no means a cheap 27in monitor – unless you compare it to the Eizos – but it marries all-round quality with ease of use thanks to a puck that allows you to quickly move between settings. You can even daisy chain a second Thunderbolt 3 monitor for a monster setup. **£859 from photospecialist.co.uk**

REVIEW Issue 327, p80

Eizo ColorEdge CG279X

Designers who need to work across different disciplines will love how easy it is to switch between the Adobe RGB, DCI-P3 and sRGB colour spaces using the Eizo's fantastic OSD. It's certainly not cheap for a 27in 1440p monitor, but it's packed with quality. **£1,726 from wexphotovideo.com**

REVIEW Issue 327, p84

WEBCAMS

Epos Expand Vision 1

Top-quality 4K video from £142
from uk.insight.com

Videoconferencing expert Epos claims the top spot with its first personal webcam. It delivers on all fronts: audio quality, colour accuracy and low-light performance, and all while undercutting the 4K Logitech opposition by £100.

REVIEW Issue 340, p74



Aukey PC-W3 1080p Webcam

If the thought of spending £142 on a webcam has you spluttering into your microphone then you should consider this far cheaper but high-quality alternative. Its colours are low-key in comparison to the best, but it still produces a sharp and detailed image. **£13 from ebay.co.uk**

REVIEW Issue 321, p72

Obsbot Tiny 2

This portable 4K webcam delivers for quality, design and sharpness, and it comes with a shedload of advanced features, including dynamic zoom and subject tracking. The only real downside is that it has a price that reflects its premium ambitions.

£329 from amazon.co.uk

REVIEW Issue 352, p75

HOME OFFICE PRINTERS

Epson EcoTank ET-2830

Ink tank all-in-one for £250
from epson.co.uk

Don't expect flashy features, but do expect fast print speeds, high-quality prints, scans and copies, plus phenomenally low running costs – even after you've exhausted the 6,000 pages' worth of bottled ink that comes with it.

REVIEW Issue 353, p85



Canon Pixma TS8750

A fantastic choice for creative users that's equally at home printing photos as it is scanning artwork. Despite its high running costs, due to its reliance on cartridges, this is a superb all-in-one. **£159 from printerbase.co.uk**

REVIEW Issue 353, p86

HP OfficeJet Pro 9012e

So long as your print volumes aren't huge – the running costs mount up – this is a superb all-in-one for home office usage. It's fast, robust, prints double-sided and produces strong all-round results.

£208 from printerland.com

REVIEW Issue 353, p87

WORKGROUP PRINTERS

Canon Maxify GX6550

Ink tank all-in-one for £392 exc VAT
from canon.co.uk

Designed to fit in tight spaces, this all-in-one includes a highly effective ADF and backs it up with high-quality prints at 24ipm in our tests. Running costs are superb, too.

REVIEW Issue 350, p58



Brother HL-L9430CDN

This laser printer (not an all-in-one, so there's no scanning or copying functionality) is a great choice for a busy office, producing sharp black text and making a good job of colour graphics as well. All while doing so quickly with a competitive price per page. **£415 exc VAT from printerland.co.uk**

REVIEW Issue 353, p84

Xerox B315DN

A fine alternative to the Brother and Canon, this mono laser multifunction printer produces superb results at great speed – 27.5 pages per minute in our 50-page test, which includes the spool time. It's similarly quick for scans, with a dual-CIS ADF to speed up double-sided copies. **£238 exc VAT from printerbase.co.uk**

REVIEW Issue 341, p87

WIRELESS ROUTERS

Netgear Nighthawk RAXE300

Fast Wi-Fi 6E router, £350
from amazon.co.uk



The RAXE500 (see right) is faster than the RAXE300, but in practice we doubt you would notice – this tri-band router still delivered speeds between 50MB/sec and 150MB/sec in our tests. And it's packed with features, too. At £150 cheaper than its bigger brother, we think it hits the Wi-Fi 6E sweet spot.

REVIEW Issue 341, p68

Netgear Nighthawk RS700S

Make no mistake – you won't get stunning speeds out of this Wi-Fi 7 router today. But if you must buy a router now and want future-proofing, this is a solid choice. But honestly, we would recommend that you wait. **£800 from netgear.com**

REVIEW Issue 353, p76

Asus RT-AX59U

You can buy cheaper Wi-Fi 6 routers – such as the D-Link Eagle Pro AI R15 for £55 – but Asus' well-priced offering delivers strong performance along with lots of control and exceptional VPN support. **£125 from uk.store.asus.com**

REVIEW Issue 350, p57

MESH WI-FI

TP-Link Deco XE200

Clever Wi-Fi 6E for £600
from amazon.co.uk

There are cheaper Wi-Fi 6E meshes, but the XE200 wins for its superb download speeds, excellent coverage and the fact that older clients reap benefits of 6E, not just new ones. And a two-pack (code BOBKTDPWCG8) should be enough for most premises.

REVIEW Issue 349, p65



Mercusys Halo H80X

A new subsidiary of TP-Link, Mercusys offers its parent brand's XE75 router some excellent value-for-money competition. Not as fast due to Wi-Fi 6 rather than Wi-Fi 6E, but it has all the bandwidth you need for everyday use and should deliver it stably throughout your house. There are plenty of features too. **2-pack, £161 from ebuyer.com**

REVIEW Issue 341, p71

Linksys Velop Pro 6E

Ironically, this Wi-Fi 6E router will get the most out of your non-Wi-Fi 6 devices thanks to its use of the 6GHz network for station-to-station traffic. And you only need two units for rock solid performance across a three-bedroom house. **2-pack, £380 from amazon.co.uk**

REVIEW Issue 350, p54



BUSINESS WI-FI

Zyxel WAX640S-6E

Tri-band Wi-Fi 6E AP, £369 exc VAT from broadbandbuyer.com

A nicely priced tri-band wireless access point ideally suited to businesses that want to provide the full range of wireless services. It's easy to deploy, wireless performance is good and Zyxel provides top-quality cloud management services.

REVIEW Issue 353, p100



Asus ExpertWiFi EBM68

Small businesses will find much to like with this simple-to-manage Wi-Fi 6 access point. AiMesh makes it incredibly easy to expand wireless coverage, performance is reasonable and it includes an impressive range of network security features. **2-pack, £540 exc VAT from amazon.co.uk**
REVIEW Issue 353, p98

Netgear WAX625

A great choice for SMBs seeking an easy wireless performance boost with minimum investment. This is an affordable Wi-Fi 6 AP with good speeds while Netgear's Insight provides smart cloud management services. **£224 exc VAT from broadbandbuyer.com**
REVIEW Issue 353, p99

NAS SERVERS

Synology DiskStation DS1823xs+

10GbE NAS, £1,413 exc VAT

from broadbandbuyer.com

This powerful eight-bay NAS is a great choice for SMBs that want plenty of capacity, features and performance at a reasonable price. The new DSM 7.2 software has security high on its agenda, and the icing on the cake is Synology's generous five-year warranty.

REVIEW Issue 346, p101



Qnap TS-h987XU-RP

The TS-h987XU-RP is a ready-made hybrid storage solution for SMBs. This rack-friendly package offers a great specification for the price, and Qnap's QuTS hero software scores highly for its wealth of data-protection features and business apps. **Diskless, £3,292 exc VAT from broadbandbuyer.com**
REVIEW Issue 344, p96

Synology DiskStation DS1522+

Small businesses that want a high-capacity desktop NAS at a good price will find Synology's DS1522+ a great choice. Performance over 10GbE is impeccable and the DSM software offers a fantastic range of storage features. **5-bay NAS, diskless £586 exc VAT from broadbandbuyer.com**
REVIEW Issue 344, p98

VIDEOCONFERENCING

Poly Studio X52 with TC10

Perfect middle man, £3,161 exc VAT

from meetingstore.co.uk

Ideal for businesses that want a professional videoconferencing solution for medium-sized meeting rooms.

Video quality is excellent, speaker tracking fast, and the big choice of built-in VC apps makes it incredibly versatile.

REVIEW Issue 353, p102



Owl Labs Owl Bar

As a standalone videoconferencing room solution the Owl Bar has plenty to offer, with good video quality and super-smooth speaker tracking. It really comes into its own when paired with an Owl 3, though, as this unleashes a completely new dimension to your meetings. **£1,999 exc VAT from owlabs.co.uk**
REVIEW Issue 352, p99

Jabra PanaCast 50

This sleek cylinder delivers great video and audio quality, fast speaker tracking and a wealth of advanced features. Jabra's Xpress web portal offers smart remote management services, and the super-wide view helps make the PanaCast 50 ideal for all-inclusive meetings. **£867 exc VAT from uk.insight.com**
REVIEW Issue 354, p100

SCANNERS

Xerox D70n Scanner

Fast and furious, £765 exc VAT

from ballicom.co.uk

The D70n delivers a mighty scan speed together with a wealth of scan management tools and apps. Businesses that want a high-volume networked desktop scanner at an affordable price should put the Xerox at the top of their list.

REVIEW Issue 346, p99



Brother ADS-4700W

A fine choice for small businesses, with an impressive range of scanning features at a price that can't be faulted. Output quality is top notch and the versatile LCD touchscreen menus provide great walk-up scan services. **£355 exc VAT from printerbase.co.uk**
REVIEW Issue 346, p96

Epson WorkForce ES-C380W

An affordable choice for offices short on space. It delivers on its 30ppm speed promises, Epson's ScanSmart software offers plenty of management features, and its standalone mode makes it very accommodating. **£280 exc VAT from ballicom.co.uk**
REVIEW Issue 351, p101

SERVERS

Dell EMC PowerEdge T350

Xeon E-2300 power, from £1,399 exc VAT

from dell.co.uk

Perfect for SMBs and branch offices looking for an affordable and powerful single-socket tower server. Along with support for Xeon E-2300 CPUs and lots of memory, it has a high storage capacity, plenty of expansion space and is sturdily built.

REVIEW Issue 335, p98



Dell EMC PowerEdge R250

With prices starting at around £850 exc VAT for a Pentium Gold CPU, and the option of Xeon E-2300 series chips from £1,461 exc VAT, this is a slim, rack-mounted alternative to the more high-powered T350 that's ideal for SMBs. **From £845 exc VAT from dell.co.uk**
REVIEW Issue 332, p98

Broadberry CyberServe Xeon E-RS100-E10

This represents a powerful hardware package at a price that will please small businesses. We love its low-profile chassis and the fine selection of remote-management tools. It's a great alternative to the Dell EMC servers also listed here. **£983 exc VAT from broadberry.co.uk**
REVIEW Issue 318, p96

SECURITY SOFTWARE

NEW ENTRY

Avast Ultimate

Buy from retail and this is a bargain, with a solid VPN, anti-tracking software and handy detection fees on top of excellent protection. **10 devices, 2yrs, £30 from store.pcpro.co.uk**

REVIEW Issue 355, p84

NEW ENTRY



G Data Total Protection

G Data provides straightforward, effective and inexpensive protection against malware and other threats to your system, making it a favourite despite its quirks. **5 devices, \$82 from gdatasoftware.co.uk**

REVIEW Issue 355, p87

NEW ENTRY

Avast One Essential

Avast One Essential has the same malware-detection engine as our top choice, but for free. It even includes 5GB of VPN services per month and a few system optimisation tools. **Free from avast.com**

REVIEW Issue 355, p89

VPNs



NordVPN

NordVPN won our VPN Labs for the second time running thanks to its consistent, fast speeds, great security features and excellent support for video streaming. **£80 for two years from nordvpn.com**

REVIEW Issue 349, p86

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REVIEW Issue 349, p86

PASSWORD MANAGERS



NordPass

This hassle-free option is a great choice for both personal and business use, with a competitive price matched with all the features most people need. **£1.89 per month from nordpass.com**

REVIEW Issue 350, p70

NordPass

This hassle-free option is a great choice for both personal and business use, with a competitive price matched with all the features most people need. **£1.89 per month from nordpass.com**

REVIEW Issue 350, p70

Bitwarden

Free for individual use and open source, the only important thing Bitwarden lacks is phone support: it works with virtually every device and browser, and the paid option is well worth £10 per year. **Free from bitwarden.com**

REVIEW Issue 350, p71

Keeper

A great choice for businesses thanks to its focus on security and a zero-knowledge policy, and if you need more options then Keeper has them. **Business edition, from £2 per user per month from keepersecurity.com**

REVIEW Issue 350, p72

ENDPOINT PROTECTION

Sophos Intercept X Advanced

Delivers a huge range of endpoint protection measures for the price. It's simple to deploy, device and user policies add flexibility, and seamless integration with the Sophos Central cloud portal makes management simple. **500-999 users, 1 year, £36.50 each exc VAT from enterpriseav.co.uk**

REVIEW Issue 351, p98



WithSecure Elements EPP and EDR

High levels of automation make WithSecure a great choice for SMBs that want endpoint protection on a plate. It's easily managed from the cloud, too. **100-499 devices, £37 each per year exc VAT from withsecure.com**

REVIEW Issue 351, p99

CLOUD STORAGE

NEW ENTRY

ShareFile Premium

Cloud file-sharing features are on a par with many other solutions, but ShareFile Premium stands out for its generous 100GB file size support. Admin features and access security are extensive, and the new pricing structure makes it even more affordable. **£19.60 exc VAT per user per month from sharefile.com**

REVIEW Issue 355, p100



NEW ENTRY

Tresorit Business Plus

Tresorit's strict zero-knowledge encryption policy, excellent value and ease of use make it a great choice for security-conscious SMBs. **£12.83 exc VAT per user per month from tresorit.com**

REVIEW Issue 355, p101

VOIP SERVICES

3CX

SMEs worried about the cost and complexity of hosting an IP PBX will love 3CX's free offering. It's easy to use and provides all the call-handling services you need. **Free for 1-10 users from 3cx.com**

REVIEW Issue 345, p96



Gradwell Wave

Ideal for SMEs that want the smoothest possible path to VoIP, this cloud-hosted service is easy to manage and packed with features. **Wave 100, from £7.50 exc VAT per user per month from gradwell.com**

REVIEW Issue 345, p98

NETWORK MONITORING

Progress WhatsUp Gold 2023.1

Simple to deploy and offers an impressive range of network-monitoring tools. The choice of licensing plans makes it an affordable option for SMBs, and support teams will love its smart dashboard and NOC views.

Enterprise, 50 devices, £1,192 exc VAT per year from whatsupgold.com

REVIEW Issue 354, p99



REMOTE SUPPORT

IDrive RemotePC Team

IDrive's RemotePC Team will appeal to SMBs that want affordable cloud-hosted remote support for their offices and home workers. It's exceedingly simple to deploy, easy to manage and delivers tough access security measures.

First year, 50 computers, £172 exc VAT from remotepc.com

REVIEW Issue 349, p98



UTM APPLIANCES

WatchGuard Firebox T45-CW

Businesses that hate internet downtime will love WatchGuard's Firebox T45-CW. It provides a wealth of top-class security services, can be easily cloud managed and delivers seamless 5G WAN failover. **Appliance with 3yr TSS, £4,015 exc VAT from broadbandbuyer.com**

REVIEW Issue 354, p103



Paessler PRTG Network Monitor 23.4

A highly versatile network-monitoring package that delivers a wealth of information, and its all-inclusive price makes it a great choice for SMBs. **1,000 sensors, 1yr maintenance, €2,649 exc VAT from paessler.com**

REVIEW Issue 354, p98

NetSupport Manager 14

Delivers a wealth of support tools, including secure access to home workers, and licensing plans are good value. **1-500 systems, perpetual licence, £10 each exc VAT from netsupportmanager.com**

REVIEW Issue 349, p100

Zyxel ZyWALL ATP500

This desktop appliance gives sophisticated protection against zero-day threats, is easily managed and very good value. **Appliance with 1yr Gold Security licence, £1,191 exc VAT from broadbandbuyer.com**

REVIEW Issue 348, p99



Cloudy thoughts: our scattered data could be lost

What holds a lifetime's work together if it isn't in physical form?

One thing is for sure: you can't rely on Google



Dick Pountain is editorial fellow of *PC Pro*. After finishing this column, he needed a dram of Caol Ila. Email dick@dickpountain.co.uk

Internet culture was once expected to join the whole world together, and in some ways – such as email – it still comes closer than any previous technology. However, in other ways it divides us up into radically different camps and silos, especially when it comes to publishing one's own multimedia content.

This thought occurred to me recently when I finally succumbed to curiosity by opening a Substack account. I'd been hearing about this service for several years, as used by many people whose work I read, so I decided to put up some of the material from my existing Blogger blogs and website.

My first impression was deep confusion, greater even than that I feel on Instagram. Substack combines a blog for publishing new short material with a website for long-form essays, an email distribution and publication system, plus a system for getting paid. Gazing at its opaque UI, it suddenly flashed on me how many places I now have my own "stuff" online, most of which don't pay anything at all.

I generate content in the following media: text, like this column you're reading, plus book reviews for other print publications; pictures, photographs and digital art; and music, some computer-generated, some played, some just curated playlists of other musicians' work.

I currently keep text online on Blogger, Medium, Substack, OpenDemocracy, The Political Quarterly and several smaller publications, plus a book published in Amazon's Kindle store. I have photographs online at Flickr,

Facebook, Instagram, Tumblr and my own website. I have music on YouTube, SoundCloud, Bandcamp and my own website, plus hundreds of playlists on Spotify and YouTube. That makes at least 20 different places with different addresses and logins, some with payment systems – which only generate any revenue if I spend to advertise.

I also maintain my own website, dickpountain.co.uk, hosted for free on Google Sites and plain in both appearance and features, although I did recently port it to Google's New Sites standard. It contains a few short essays on computing, music and politics, but largely exists as a hub from which to access all those 20+ other repositories. My SEO skills are modest, so people are more likely to arrive at them by Googling rather than via my site, and when they do arrive they're unlikely to cough up any cash because I spend nothing on promotion. Making a living online has never figured among my life goals, but I do like people to see my work.

The one online medium I've never embraced is the podcast, partly because I don't really like my flat, East Midlands speaking voice when recorded. However, I did recently participate in one, via an extremely circuitous tour of the contemporary media landscape. Get ready for some time travel.

In 1990, I drove to Prague with my brother-in-law Pip in his vintage 1937 Lagonda car, our purpose being to see Václav Havel installed as president and to witness Pip's friend Berty – who'd had to flee the Russian invasion in 1968 – be given the keys to the city.

Fast forward to 2017, when an old friend and colleague Mark Williams started a magazine called *Classic Motoring Review*

"The world's in a febrile and unstable state right now (to put it mildly), so how long can one expect one's cloud content to survive?"

and asked us both to write up our trip for him. Skip forward again to October 2019 and Mark's magazine has sadly folded, but I post our article from it to Facebook. Flashback: in 1983 Pip had founded the Scotch Malt Whisky Society to spread knowledge of the virtues of unfiltered, cask-strength single malts.

Forward again to Oct 2023; Pip shows my Facebook post to the editor of the society's magazine *Unfiltered*, who decides to republish a full-colour version with an attached podcast of us reading it. Now, Pip lives in Montrose, I live in London and the society is in Edinburgh, so meeting to record was out of the question. I scrambled to test Android audio-editing apps, found two that worked (Lexis Audio Editor and Bandlab), recorded my half, and you can judge the result at tinyurl.com/355prague.

While it was quite satisfying to add voice to my media types, it did prompt a rather morbid thought. The world's in a febrile and unstable state right now (to put it mildly), so how long can one expect one's cloud content to survive after, say, a catastrophic cyberattack like the one in the recent movie *Leave The World Behind*? That could wipe the lot. Once upon a time when an author died, people went through his or her papers, the books on their bookshelf, visited their publisher. All solid, material stuff – paper, cardboard, photo prints, paintings, film, tape. How's that going to work in cloud land? Once Google goes down it's all just so much scattered data.

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"My first impression of Substack was deep confusion, greater even than that I feel on Instagram"

Privacy's biggest challenge is boredom

I've written about online privacy countless times, so why can't I take my own advice?



Nicole Kobia is PC Pro's Futures editor. Please don't take this as an invitation to invade her privacy. X@njkobie

Do you want to know how to stay private online? I can tell you, but don't ask to see my own settings. I've been writing about technology so long that certain how-to pieces can't help but repeat. Some of that is the cyclical nature of the industry – how many AI boom and bust cycles will we endure before we learn to stop hyping the idea beyond its capabilities? – but it also reflects the nature of the challenges created by the rise of the web, smartphones, social media and so on. After all, Facebook turns 20 this year, and Mark Zuckerberg's executives still haven't solved privacy issues on the social media giant.

So it's no surprise that one of the topics I keep coming back to is online privacy. This makes sense: the tips and tricks need to be regularly updated and spread as widely as possible. But something struck me in my latest foray into the subject, as I meticulously worked through settings on social media, smartphones and web platforms: I have always ignored my own advice.

I can't help it. I struggle to care about my own online privacy. I mean,

"I'll advise anyone using social media to regularly check their privacy preferences. Have I done that myself? Of course not!"

I do think it's important. But unless I'm being paid by the word to explain security settings, I'll leave them at their defaults.

I'll happily advise anyone using social media to work through their privacy preferences regularly, to ensure you haven't accidentally given permission to a dodgy app to view your data or that the site in question hasn't changed how its privacy model operates. Have I done that myself? Of course not, it's too boring.

I have an ad-blocker extension enabled on my Chrome browser, but that's less to do with privacy and more to do with loading times. And if a dodgy gossip site begs me to disable the extension to access its questionable content, I do so every time. Cookie pop-ups? I know I should carefully read through the settings. Instead I click to accept the default mode, full of trackers, because I can't be bothered. I hate the thought of Google Photos training its facial recognition systems on my toddler's beautiful face, but I also like being able to effortlessly see photos of her from key milestones. I am lazy and I treasure convenience.

I'm not totally open online. My Instagram and Facebook accounts are set to private, I've stopped signing up with every single retailer to buy a single item, and I've gone through the basic privacy settings on my phone. But beyond that, it's all just so tedious, with no obvious positive outcomes. Part of me suspects that no matter the settings I choose, Silicon Valley will find another way to stalk me, and that even if I stopped it now,

they have so much of my data it no longer matters.

This is a bad attitude, I admit. But it's also inevitable – and perhaps what the tech industry hoped would happen. The various companies

make it possible but onerous to protect ourselves from their advertising algorithms, hoping we can't be bothered. But privacy should be the default, not something we need to opt into a million times before finally giving in, worn down and frustrated and not even sure if such efforts are making a difference.

So you should follow the advice I give when I write about privacy. It's good advice. But even better would be for regulators to finally sort out this

issue and give us privacy by default, rather than the mess we now have. Social media, smartphones, online retailers and advertisers shouldn't assume that our personal identity and private data is theirs to monetise. It's governments, regulators and tech

"Privacy should be the default, not something we need to opt into a million times before finally giving in, worn down and frustrated"

companies that should take action, rather than each and every one of us.

And that is happening, sort of. The EU has upped its game when it comes to data privacy, but perhaps more significantly Google is finally trialling a long-promised system to banish third-party cookies that track users across the web. When the system is eventually rolled out, advertisers won't be able to chase you from site to site with banners reminding you of that pair of shoes you looked at before deciding not to buy six months ago. Instead, if they want to target ads, they can ask Google for your personal likes based on your search data. That means advertisers will still know about you without stalking you quite so closely, even if it makes Google more of a gatekeeper to people on the web.

There's no perfect solution as long as the web is funded by advertising. Until that changes – which doesn't seem very likely in the near future – I know I should switch to a different browser, upgrade my email provider, and think before I click "accept" on cookie pop-ups, but I also know it's unlikely. In the meantime, keep reading the good advice technology journalists, myself included, tell you about staying private and safe online – but do as we say and not as we do.

 work@nicolekobia.com

Give me Media Centre on a Mac

Rehoming an iMac in the kitchen poses interface issues, especially when the keyboard is such an unwelcome house guest



Barry Collins is a former editor of PC Pro. He was sent the first Windows Media Centre PC to ever arrive for review in the UK... and couldn't get it to work, either.
X@bazzacollins

Regular listeners to the PC Pro podcast – those who are back in the community and not judged to be a danger to the wider public – may recall that last year I bought a refurbished ten-year-old iMac. And almost since the moment it touched down here at Collins Towers, I've been wondering what to do with it.

It's long been rid of macOS and revitalised with Linux Mint, making it a sprightly system once more, but I've struggled to find a day-to-day purpose for it. Apple kiboshed the option to use it as a secondary screen for my MacBook Pro. I've dallied with using it as a retro games emulator, loading all sorts of classics by live booting Batocera from a USB drive. But here's the thing about retro games that they don't tell you: they're retro because they're just not that good any more. That game you remember fondly from your childhood? Face facts, it's utter cruff by 2024 standards.

Consequently, that still lovely piece of retro hardware was gathering dust in my office, in serious danger of being demoted to the garage where it would end up having its cables chewed by the mice before being dumped.

And then its reason for being, its long-awaited role at Collins Towers became glaringly obvious. A couple of years ago, we upgraded the Amazon Echo Show 5 in our bedroom to the larger Echo Show 8, making it easier on our close-to-50-something eyes to watch video in bed. The Show 5 was sent down to the kitchen, where my other half has taken to using it for watching 98-episode Netflix bilge while she's cooking. The iMac could be pressed into action as a kitchen

media centre, providing a sizeable screen upgrade on the dinky Echo.

This required sensitive handling. While I was reasonably confident she would appreciate the bigger screen, the merest smattering of a suggestion that I was doing her a favour by making it easier to watch TV while performing domestic chores could seriously backfire. It wasn't quite buying her a microwave oven for her birthday, but it was dicey territory, a move that could rapidly increase my Pot Noodle consumption if bungled.

Fortunately for my calorie intake, the idea went down well. The iMac's elegant lines and small counter-top footprint definitely helped swing the deal, but there were sticking points. "Do we really need that keyboard and mouse with it?" being one of them.

Now, as I'm sure you're aware, even 2024 iMacs don't have touchscreens; our 2013 model certainly doesn't. So the only real way to ditch the keyboard would be to find a Windows Media Centre-style interface that could be navigated exclusively with the mouse. Something with nice big icons to open Netflix, iPlayer, Spotify and all the other streaming services that comprise modern media consumption.

Windows Media Centre has long since shuffled off into obscurity – not that it would be much help on a Mac running Linux anyway. The closest equivalent I could find was Kodi, a media-centre-style interface that I'd fiddled with in the past.

Yet, while the Kodi interface ticks a lot of boxes, the software is still very much geared towards media served locally, not the streaming services that Collins HQ has come to rely on. Yes, you can install an add-in for YouTube, but that borked at the sign-in stage, forcing me into endless login loops. There's also a way to

“Isn't it a pity that there's not more variation in the UI of mainstream operating systems these days? Not every PC is plonked in front of a desk”

install Netflix, but it requires loosening Kodi's security settings, installing an unofficial repository and saying Hail Mary three times on a Tuesday. It's all too much hassle.

So, we've eventually brokered a compromise. The bog-standard Cinnamon desktop interface for Linux Mint has been tidied up somewhat, with only the Firefox browser and streaming apps such as Spotify pinned to the taskbar. The Firefox home screen is now replete with chunky shortcuts to Netflix, YouTube and the other streaming accounts, and they're all pretty easy to navigate with mouse alone.

Still, isn't it a pity that there's not more variation in the UI of mainstream operating systems these days? Why is there nothing like Media Centre or even Windows 8's much-derided Start screen to provide options for people who are using computers for different purposes? Not every PC is plonked in front of a desk. And even recently launched systems, such as the HP Envy Move with its unusual carry handle, are angling for people to use them in rooms such as the kitchen, where a mouse and keyboard are hardly natural accompaniments to the cooking utensils and Jamie Oliver cookbooks.

Perhaps Apple would prefer I used something like the Apple TV for that job. Maybe Microsoft thinks an Xbox is better suited. But that ten-year-old iMac is a perfectly good counter-top computer. It just needs an operating system to match.

barry@mediabc.co.uk

“It wasn't quite buying her a microwave oven for her birthday, but it was dicey territory”

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Readers' comments

Your views and feedback from email and the web

Laptop lite

I've never understood why nobody sold a laptop without a screen or a battery, especially in days gone by when even simple laptops cost a couple of thousand pounds. The battery and screen were two of the most expensive items on a laptop, and if you asked most people they only ever used their machine at either work or at home - and then they plugged them into the mains and attached them to a desktop monitor.

With that in mind, manufacturers could have put the mains adapter in the battery space, which could have reduced the price by around £1,000. Even now I think the idea applies: few people seem to use a laptop without being in easy reach of a mains socket, and with screen casting technology now available any laptop could be wirelessly connected to a cheap smart TV, significantly reducing the price and weight of a laptop.

Michael Albin

Editor-in-chief Tim Danton replies: You're definitely going against the modern trend of more displays rather than none (see my reviews of the ThinkPad X1 Fold, p58, Asus Zenbook Duo, p60, and even Honor's Magic V2 phone on p70), but it's an interesting question. And almost a philosophical one: at what point is a laptop a laptop? Moving rapidly on, one project I'm watching with a tingle of cynicism but also some interest is Spacetop (sightful.com), which went on sale in the US only in January. It's a \$2,150 laptop without a screen, using AR to display a 100in screen instead. Let's see if it ever makes it to the UK.

Recurring nightmare

I read Lee Grant's article (see issue 354, p113) in which he mentions



ABOVE A laptop with no screen: the Spacetop uses AR for its display

recurring subscriptions, and I would like to add a footnote. I recently received an email from McAfee telling me my antivirus subscription was due for renewal on my Toshiba PC and that would be £79.95 please.

I now use an LG laptop and before that it was an HP. As I remember, the McAfee came installed on the Toshiba when I bought it. I used the "lost password" prompt and logged in to the account to cancel the subscription, only to find out that the payment had also been set to recurring on PayPal, to a closed McAfee account. The renewal email said I would receive a refund if cancelled within 14 days, but the PayPal payment may have complicated things a little.

A very different experience from Microsoft when it came to my Office 365 renewal, which asked me if my payment method was still relevant and required confirmation in my online banking app.

Michael G Magee

Missing MX Linux

I enjoyed Nik Rawlinson's Linux Distros article (see issue 354, p78) but

was surprised that MX Linux wasn't mentioned. This is the most popular Linux distro according to Distro Watch and I have found it to be excellent.

Simon Unwin

Nik Rawlinson replies: Glad you enjoyed the Labs! MX Linux was on our original list (and we covered it in the previous Linux Labs) but as mentioned in the introduction we had to make some hard decisions when whittling down to a practical number. And, as MX Linux is one of many Debian-based contenders, we decided to make room for a couple of the less familiar entries and distributions with alternative roots.

Farewell to HP

At long last I've taken my HP all-in-one printer to the skip and replaced it with an Epson. I had become very disillusioned with HP over the years with its overpriced cartridges and attempts to convert to a subscription ink model, which wouldn't suit me. On top of that, it forced me to sign up to its phone app so that I could use the scanner on the printer. It even remotely changed the printer to stop me doing double-sided colour copies; something it used to do and now said it couldn't!

The final straw was it complaining that an ink cartridge was not able to do "Continuous Printing" – whatever that means. Good riddance to it!

Paul Girdham

Editor-in-chief Tim Danton replies: One of the reasons why we're such fans of ink tank printers is that it moves away from these shenanigans, which are basically about printer manufacturers pushing people to their own cartridges rather than cheaper third-party alternatives.

Star letter

Taking the biscuit

I'm surprised at Lee Grant's observation (see issue 354, p113) that he has encountered a faulty CPU just five times in 20 years. On one of the few occasions I attempted to repair my own non-working PC, I temporarily removed the cooler to access the RAM located immediately next to the socket. Moments later I had accidentally re-powered the motherboard.



I estimate the length of time for the melting point of silicon to be reached was 120ms. Perhaps if I had reassembled the remains and shipped them to Yorkshire, Lee would have reached the count of six earlier in his long and illustrious career. That unfortunate incident does, however, allow me to present this anecdote as further evidence for the main thrust of his article: that in life, there are times when only a chocolate Hobnob will do.

Tim Davey

Contributing editor Lee Grant replies: Good effort, Tim. It's incredibly easy to power on a machine without realising. The whoosh of cooling fans normally indicate it's showtime, but fanless devices (as you discovered) are tricksy. Always pull the power, especially laptop batteries, as magnetised screwdrivers and sensitive Hall sensors can unexpectedly start a device, causing a catastrophic over-dunk, dropping half a biscuit into the beverage – a disaster.



This month's star letter writer wins a Cherry KC 200 MX mechanical keyboard, worth £80, recipient of a five-star review and a PC Pro Recommended award. Email letters@pcpro.co.uk

Readers' poll

We asked: now that Microsoft has integrated its Copilot AI into the Office apps, which of these best describes your views?

(Note that we offered HP the chance to reply to this particular query, but it chose not to respond.)

Big-sheet printing

It's obvious that both hardware and software have improved in speed and (perhaps hopefully) quality over time. However, back in the day I wrote a piece of software that would print a banner on an Epson 80-column dot matrix printer, controlling each dot as required. That was for a family tree printout as a seven-metre banner (it took about five hours to print). I seem to remember that there was a paper roller attachment to the printer, or else Z-fold paper could be used.

Nearly 40 years on, the family tree really could do with an update, but would you have any ideas for a banner style (or continuous roll) printer option these days?

Ray Cramer

Contributing editor Jon Honeyball replies:
Most roll-feed printers are big pro photo printers, like my old Epson Stylus Pro 4880, and if you have deep pockets there are professional Epson SureColor printers that I'm sure produce terrific results (but I haven't tested them). More affordably, the sub-£300 Canon Pixma G4570 can do custom sizes up to 216mm wide and 1.2m long, and the sub-£150 Canon Pixma TS7750i can do the same.

Shop shock

Farley David (see issue 354, p25) suggests that supermarkets may or should offer clever technical solutions to find the products you want quickly in their stores.

The cynic in me (and the realist in a capitalist system) says that these stores exist to make profits for their shareholders, not necessarily to make their customers' lives easier. In this case it is probably better for the store to leave you to find your product by searching aisles, as you're more likely to buy something in addition to what you're looking for on impulse as you see it on your search.

The stores then increase this effect by reshuffling stock every now and then so even regulars don't know where everything is.

Reinforcing this view is the fact that it's been possible for a long time to offer this and many other types of smart help but, despite decades of retail refinement in supermarkets, none of them has done it.

Peter Sherwood



The numbers don't lie. Even among *PC Pro* readers, there isn't yet a great deal of love for Copilot. Yet, Robert Gough, answering on Facebook, summed up the mood well: "I usually find such things more hyperbole than genuinely and sufficiently useful for my needs." Stephen Cornish felt similarly, saying he was yet to be convinced but that "I wait to embrace it at some point when it's improved and the hype dies down".

Others are more positive, including Graham Steel. "I have Office 2019, which presumably will not be getting Copilot integration (*it won't – Ed*). I do like Copilot on the desktop... (as) it produces concise and very relevant responses to my queries: more efficient than wading through a list of search results, trying to identify an appropriate one."

Perhaps the best news for Microsoft is that it seems that people who have used Microsoft Copilot Pro or Copilot for Office 365 like what they see. "I use it regularly to save time generating content or summarising topics for email, etc," wrote James Brenan on X. "It's been great for my productivity."

@Murgatroyd99 on X was equally upbeat. "I use it to help with VBA coding and creating complex Excel formulas. The human aspect is having the skill to ask in the best way to get a good result. I am a coding novice and it is helping me to learn very quickly, often guessing my next question too."

We'll give the final word to Nick Kitchen, who we suspect might just be a Douglas Adams fan. "I'm still using Word 2003 so I'm waiting until the AI becomes so intelligent it goes back in time and integrates itself into all Microsoft products since MS-DOS. Or maybe it's been the mice all along."

"I use it in Bing at the moment, and I love it.  Lee Friend

"I've stopped Googling and just present Copilot with specific questions and tasks.  John Moore

"I don't need any more subscriptions.  John Wright

"I asked Copilot and it said to tell you that it's brilliant.  Paul Ockenden

"I tried Copilot and it suggested an app that stopped development in 2009 and for NT4.  @mrg9999

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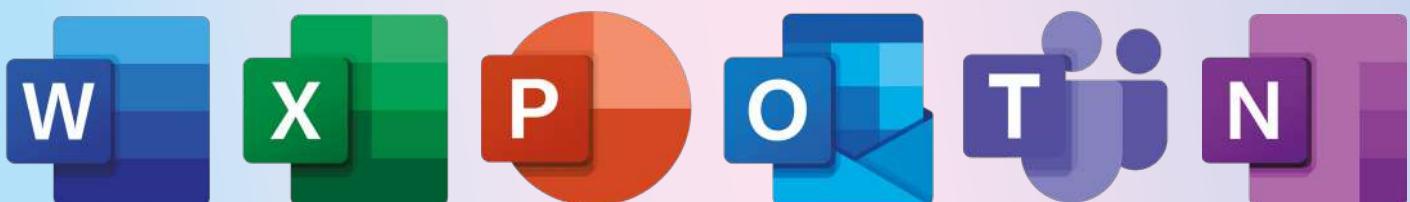
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COPILOT PRO & COPILOT FOR MICROSOFT 365

Why Copilot is great, when it's awful and which version you should buy

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Ah, Microsoft. How we love your ability to create world-dominating software with one hand and sow world-beating confusion with the other. In January, finally, it announced that Copilot for Office was available for all. Except, this being Microsoft, calling it Copilot for Office would be too simple. Instead, we now have the free Copilot, Copilot Pro and Copilot for Microsoft 365. (And Windows Copilot, GitHub Copilot and a trio of Sales, Service and Security Copilots, but let's ignore these distractions.)

Now, vanilla Copilot has nothing to do with Office. It's the successor to Bing Chat and, unless you choose to download the Copilot apps for iOS and Android, you'll access it via the web. As it's based on GPT-4 and GPT-4 Turbo, though, it remains a powerful tool – especially when you consider that Microsoft doesn't charge a penny.

Copilot Pro, which costs £19 inc VAT per month, is a different beast altogether. If you already have a Microsoft 365 Personal or Family subscription then a Copilot button inveigles its way into the main apps: Word, Excel, PowerPoint, OneNote and Office. However, let's lay a big, fat caveat here: it's only for the desktop apps on Windows for now. Apple fans are restricted to web apps and iPadOS. As you'll discover, this "it's coming soon" mantra is a recurring feature for Copilot Pro.

There are two other good reasons to consider paying the £19 per month. One is that you get "priority access" to GPT-4 during peak times, so you both get to feel smug and wait shorter times for results. The other is that it



ABOVE Copilot sits at the heart of Microsoft's strategy and its Microsoft 365 offering

gives you 100 daily "boosts" in Microsoft Designer, which is powered by OpenAI's DALL-E 3, compared to 15 from plain Copilot. A "boost" translates into fast GPU time, so again you'll rarely find yourself waiting for images to be created.

Finally, we come to Copilot for Microsoft 365. This is Microsoft's AI heavyweight, adding full integration with SharePoint and adding Teams to the mix. For now, Teams is the best Copilot integration by a distance. As we'll discuss, it has the potential to save employees a lot of time – but also requires your business to invest heavily in IT time, particularly during the setup stage, and money forever.

Until recently, Copilot for Microsoft 365 was limited to businesses with over 300 seats. Now, any size of business can buy it – even a one-seat business, as it

works with any Microsoft 365 Business Standard or Business Premium subscription. Larger businesses will need a minimum of a Microsoft 365 E3 subscription.

So, what is Copilot? In short, it's complicated. Here, then, to hopefully answer all your questions, is our guide to what Copilot can do for individuals and for businesses.

COPILOT FOR MICROSOFT 365 OR COPILOT PRO?

Copilot Pro is designed for individuals. It gathers its data from the document you're working on and from the web; it won't look any further. Disappointingly, it doesn't yet search your personal OneDrive documents, although we expect this feature to land at some point this year.

Copilot for Microsoft 365 is the much bigger brother, aimed solely at businesses. With no set minimum of employees, however, any size of business can benefit from Copilot for Microsoft 365's key feature: that it can gather all your relevant data stored on SharePoint, whether it's in Word docs, Excel sheets, PowerPoint presentations or Teams calls. (The Microsoft 365 roadmap says OneDrive will also be searchable come May.)

Adam Timberley is an IT consultant, and one of his clients asked him to be part of an early team using Copilot for Microsoft 365. "I found Copilot was really good [for Teams]," he said, and its skills went well beyond transcriptions and action points. "You could go back and ask it questions. What did this person say? Why did they say it? You could even ask it for its opinion. It was sometimes useful, but it did go down a creative route sometimes and you ended up getting things wrong." So, is it as reliable as talking to a work colleague? Adam laughs. "Depends on

	FOR INDIVIDUALS	FOR ORGANISATIONS		
	COPILOT	COPILOT PRO	COPILOT	COPILOT FOR MICROSOFT 365
	Free	£16 (£19 inc VAT)	Free	£25 (£30 inc VAT)
Foundational capabilities	●	●	●	●
Web grounding	●	●	●	●
Commercial data protection	●	●	●	●
Priority GPT model access		●		●
Copilot in Outlook, Word, Excel, PowerPoint and OneNote		●		●
Copilot in Teams				●
Microsoft Graph grounding				●
Enterprise-grade data protection				●
Customisation (GPTs)		Copilot GPT Builder		Copilot Studio

Prices are monthly and direct from Microsoft



the work colleague.” You can read Adam’s full review of Copilot for Teams on p33.

Copilot for Microsoft 365 is also powerful due to its access to your data. Microsoft calls this process “grounding”, so where Copilot Pro uses “web grounding” – that is, it uses the internet (and sometimes the active document) as sources to answers to your queries – Copilot for Microsoft 365 has access to your company data, so long as the user has the correct privileges. This can not only save you, the user, time, but it may also draw in information you would otherwise not have seen or noticed; perhaps drawn from a meeting on the topic that you didn’t attend.

However, you can’t 100% rely on Copilot, as Adam discovered when he tried to use AI to create a PowerPoint presentation for a military client. At first, it looked great: some carefully selected prompts, using DALL-E to create the images, produced a compelling set of slides. “Then I decided against it because it had come out with so many incorrect statements and so many pictures that were obviously AI generated. I thought, no, if I take that into a high-level meeting with a general and they reveal me to be using AI, I could be in serious trouble here.”

This flags two things. One is that Copilot for Microsoft 365 is much more powerful than Copilot Pro – yes, this can also create presentations automatically, but only from data drawn in from the web or the document you’re working on – but the second is that it brings danger. In particular, if you fail to label a file as confidential then it could be surfaced by a Copilot query by anyone in your company. It doesn’t take much imagination to see how badly that could go wrong.

If your business has fewer than 150 employees, then you’ll need to rely on your partners’ expertise to leap that particular hurdle. However, Microsoft is offering free support to larger businesses; read “Does your business qualify for FastTrack support?” on p32 to find out if you’re one of the lucky ones.

CREATE YOUR OWN COPILOT GPTs

Businesses using Copilot for Microsoft 365 can create their own AI assistants already, although “AI assistant” pushes the definition: chatbot is a better word. Essentially, the tool directs Microsoft’s large language

The main interface shows a sidebar with 'CAPABILITIES' and sections for 'Customize', 'Build', 'Design', and 'Platform'. Under 'Customize', there are four expandable sections: 'Handle mission-critical scenarios', 'Boost productivity by automating workflows', 'Use the power of your data', and 'Customize connectivity'. An inset image shows a laptop displaying the Microsoft Copilot Studio interface, which includes a 'Chat' window and various project management tools. Below the main interface is a screenshot of the OpenAI GPT Store, titled 'GPTs', showing various AI models like 'The Big Game Party Planner', 'Tutor Me', 'Draw to Style', 'Murder Mystery Mayhem', 'Image generator', 'Logo Creator', and 'Diagram Show Me'.

model at your choice of data. So, if you sell bathroom fittings then you could point it to a brochure or your website and the LLM will devour the data and then answer questions on it. In this use case, it’s like a glorified user manual that you can chat to.

If you read our guide to creating an OpenAI GPT two months ago (see issue 353, p30), then you will not

only be familiar with the concept but realise that the two tools are essentially the same but in different clothing. We’re not criticising, though, as GPTs have the potential to be superb, specialised personal helpers. You can also fine-tune them during and after their creation, as you spot things you don’t like or if you want to add extra skills or sources.

In businesses, there are some immediate uses – employees could ask GPTs about HR information, background on clients, a who’s who of your organisation. And if you head to OpenAI’s GPT Store (chat.openai.com/gpts) then you’ll see the kind of things that have already been created by communities and companies. For example, there’s a Wolfram GPT, a PowerPoint slide-making tool, and tutors in numerous topics.

For now, only Copilot for Office 365 subscribers can create their apps, in Microsoft Copilot Studio (tinyurl.com/355studio). Copilot Pro subscribers must wait for the arrival of Copilot GPT Builder. Just like the lack of OneDrive integration, it’s frustrating that Microsoft has started to sell Copilot Pro without this facility. All we know is that it’s “coming soon”.

INTEGRATION WITH OFFICE APPS

Subscribers to both Copilot Pro and Copilot for Microsoft 365 can take advantage of the AI’s integration with Office apps. As already mentioned, that means Word, Excel, PowerPoint, OneNote and Outlook for Copilot Pro users, while business users get the huge benefit of Teams integration.

The strength of AI in those apps often comes in its ability to simplify a chunk of information. For example, in Outlook it can make sense of a multi-person conversation that’s taken place over days; superb if you’ve just come back from holiday. In Word, it can condense a 30-page report into a one-page summary, complete with references. In OneNote, it can turn handwritten notes into action points.

Microsoft has done a good job of integrating Copilot into the Office apps. It sits in the Home toolbar, and the sole time it’s pushy is when you open a new document in Word and a Copilot prompt appears. The only aggravation is that it’s a cloud-based service, so you need an internet connection and will have to wait a few seconds for the results to appear.

Although it’s subtle in appearance, Copilot (both Pro and for Microsoft 365) is the strongest reason yet to keep using Office rather than switching to one of the many free alternatives. When OneDrive integration appears, it will be even more powerful.

CREATE IMAGES WITH DALL-E

Although Midjourney remains our favourite image-generation tool, if you don’t fancy paying a minimum of \$8 per month then Microsoft’s Designer (designer.microsoft.com) is well worth visiting.

As we mentioned above, the nominal difference between plain



ABOVE An image created with prompts in Designer (although the PC Pro logo was added in Photoshop)

Copilot and Copilot Pro is that while non-subscribers get 15 “boosts” per day for free, Copilot Pro users enjoy 100. In our tests, however, the key benefits are that paid-for users get three or four images with a 16:9 aspect ratio (1,792 x 1,024), while freeloading plebs are only offered two images to choose from with a square aspect ratio (1,024 x 1,024).

The results are more than good enough to include in PowerPoint presentations, and Designer’s big advantage over Midjourney is ease of



ABOVE Copilot subscribers enjoy more “boosts” to use in generative AI tool Designer and can create bigger images

use. It takes seconds to create your first image. As with all generative AI, though, the better you become at prompting, the better results will be.

Where Midjourney excels is refinement. If you like an image but it’s not quite right, then you can iterate by adding an extra parameter. With Designer, you have to rerun the command with slightly altered phrasing. This generates a whole new set of images that will be unrelated to what you had before.

It’s also harder to create photorealistic images with DALL-E than it is with Midjourney – somehow there’s always an AI veneer – and that means your results can look samey, as if they’ve been drawn by one artist.

FREE AND PAID-FOR COPILOT ALTERNATIVES

Ignore the seemingly endless number of companies creating AI models based on GPT; this handful of genuine Copilot alternatives are actually worth considering

CHATGPT, CHATGPT PLUS, CHATGPT TEAM

PRICE ChatGPT, free; ChatGPT Plus, \$20 per month; ChatGPT Team, \$30 per month from chat.openai.com

Plain old ChatGPT is starting to look both old and plain, relying as it does on GPT-3.5 and – unless you download the iOS and Android apps – the stark web interface. Nor does it offer any way to create images. Where it wins compared to the free version of Copilot is that you get to keep your history, while there’s no limit on queries or interactions.

Things get more interesting with ChatGPT Plus. The interface is the same, but you can create GPTs (see our guide to these mini-chatbots in issue 353, p30) and connect with third-party services. That means it can do things such as plan holidays and make restaurant bookings. It’s also brilliant at analysing data, making sense of complicated spreadsheets, for example. Like Copilot Pro, it gives you access to DALL-E for image creation – but we still prefer Midjourney.

There’s one final point in ChatGPT Plus’ favour. At \$20 per month, it’s cheaper than Copilot Pro for



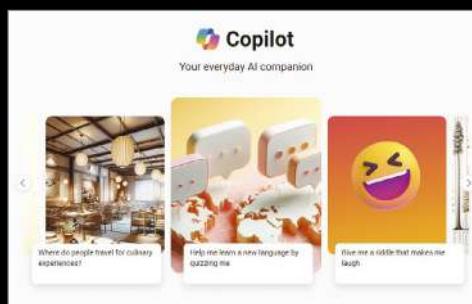
UK users: at time of going to press, that worked out as a shade under £16.

OpenAI is hoping to lure more businesses to its service, too, with a new service called ChatGPT Team. This provides an admin console, the ability to share GPTs within your workspace and higher caps on GPT-4 and DALL-E.

MICROSOFT COPILOT

PRICE Free from copilot.microsoft.com

There is a free version of Microsoft Copilot, and it’s available to everyone via apps on phones and its website, copilot.microsoft.com. There are several key differences to Copilot Pro. First, it doesn’t integrate with Office apps, which is, after all, arguably the biggest draw of the service. Second, you can’t create Copilot GPTs. Third, during peak times, you’ll likely be stuck with GPT 3.5 rather than the more powerful and up-to-date GPT 4. And fourth, image

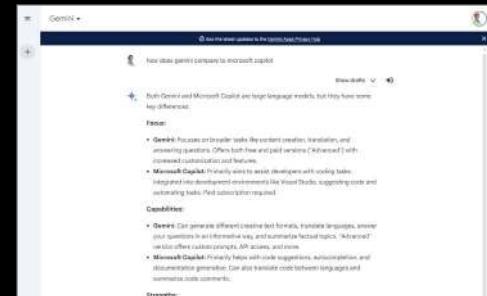


generation is restricted to 15 “boosts” per day and you may need to wait longer (depending on demand).

GOOGLE GEMINI, GEMINI ADVANCED

PRICE Gemini, free; Gemini Advanced via Google One, £19 per month from gemini.google.com

The basic version of Gemini is free, as was its predecessor Bard until Google replaced it in February. This free version of Google’s LLM isn’t as powerful as GPT-4, but its not-so secret weapon is integration with Google services such as Calendar, Gmail and Drive. So you can tell it to hunt through all your documents looking for mention of a certain keyword and then produce a summary.

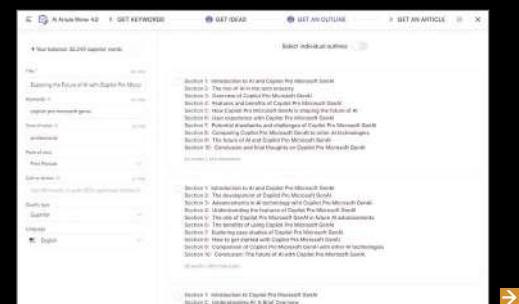


However, Google hopes you’ll upgrade to Gemini Advanced, which is now part of its One AI Premium offering. This includes what Google describes as its “most capable model, Ultra 1.0”, and it certainly offers more nuanced, creative answers than plain Gemini. It’s early days, though, with no capability to create images and no integration with Docs or Gmail. Fortunately, Google sweetens the deal with 2TB of storage and a VPN.

WRITESONIC

PRICE Free to \$20 per month from writesonic.com

Occasional writers might find that this handy tool does what they need: kick things off. The Article Writer is a great way to turn an idea into – as the name suggests – an article, even if it’s likely to be a tad bland. Or you can use Writesonic to generate a structure, to rewrite your copy or simply use it to generate ideas. The free version is restricted to GPT-3.5 and includes 10,000 words, while the Small Team version (\$19 per month) gives you a choice of GPT-3.5 or GPT-4 (you get 200K words per month with the former, 33.3K with the latter) and extra tools such as “brand voices”. And if you need an unlimited number of words, but don’t mind GPT-3.5, you can pay \$20 per month for the Freelancer option.





While we like the fact DALL-E comes as part of the paid-for Copilot package, we can't see Midjourney fans switching over.

MASTERING PROMPTS

We keep talking about mastering prompts, and fortunately Microsoft is there to offer you a helping hand. One excellent place to start your Copilot journey is at support.microsoft.com/copilot. This includes several useful resources, including updates on what's new (Microsoft is always adding features), eight short videos showing Copilot in action – although these can be a little folksy – plus extra information that Microsoft thinks could be useful.

One example is a “toolkit” about prompting, although we'd call it a four-page PDF. This attempts to explain the “art and science of prompting”, including a section that talks about the right prompt “ingredients”. It suggests there are four such morsels.

First, the goal. This is the response you want, such as “generate five bullet points” or “write a summary”. Then there's context, so why you need it and who is involved.

Microsoft's chosen example here is “prepare me for a meeting with Client X to discuss their ‘Phase 3+’ brand campaign”. Peak Microsoft.

Then, third, comes source. That is, which information sources or samples Copilot should use. In the example it's “focus on email and Teams chats since June”, but that only refers to Copilot for 365, not Copilot Pro. For Pro, your source is your document or the web.

Expectations comes last. This is how you want Copilot to respond to best meet your expectations, such as “please use simple language so I can get up to speed quickly”.

Microsoft 365 Copilot: The art and science of prompting

1. Tell Copilot what you need

There are many types of prompts you can use depending on what task you want done.

- Learn about projects and concepts: "What is [Project X] and who are the key stakeholders working on it?"
- Edit text: "Check this product launch rationale for inconsistencies."
- Transform documents: "Transform this FAQ doc into a 10-slide onboarding guide."
- Summarize information: "Write a session abstract of this presentation."
- Create engaging content: "Create a value proposition for [Product X]."
- Catch-up on missed items: "Provide a summary of the updates and action items on [Project X]."

2. Include the right prompt ingredients

To get the best response, it's important to focus on some of the key elements below when phrasing your Copilot prompts.

Goal: What response do you want from Copilot?

Context: Why do you need it and who is involved?

Source: Which information sources or samples should Copilot use?

Expectations: How should Copilot respond to best meet your expectations?

Microsoft 365 Copilot: Prompting do's and don'ts

Get the most out of Copilot and avoid common pitfalls by learning what to do and what not to do when writing prompts.

Do's

- Be clear and specific.** Provide specific instructions to Copilot, such as topic, purpose, time, and required length.
- Keep it conversational.** Give feedback to Copilot based on the quality of its responses to help the AI learn and match your preferences.
- Give examples.** Use clear and specific keywords or phrases when asking Copilot to write a piece of text for you. This helps it generate more relevant and creative copy.
- Ask for feedback.** Requesting feedback from Copilot helps it to understand your needs and preferences, and to provide you with more relevant, helpful responses.
- Write legibly.** Use correct punctuation, capitalization, and grammar when writing prompts; this will help the AI produce better quality text and responses.

Don'ts

- Be vague.** When prompting Copilot, avoid using vague language, and be as clear as possible to receive better quality responses.
- Request inappropriate or unethical responses.** Copilot is not responsible for the content or the consequences of your writing. You should respect local laws, rules, and the rights of others.
- Use slang, jargon, or informal language.** This may cause Copilot to give low-quality, inappropriate or unprofessional responses.
- Give conflicting instructions.** Prompting Copilot to perform a task that includes multiple conflicting pieces of information in the same request can confuse the AI and result in lower quality responses.
- Interrupt or change topics abruptly.** This could disrupt Copilot's writing process. Always close or finish a task before starting a new one. When starting a new task, write “New task.”

ABOVE Microsoft's website includes several useful Copilot resources

The full example is: “Generate 3-5 bullet points to prepare me for a meeting with Client X to discuss their ‘Phase 3+’ brand campaign. Focus on Email and Teams chats since June. Please use simple language so I can get up to speed quickly.” Note the use of full stops to keep things simple.

There are more useful tips in the document. One is to start off with broader requests, and then give more details; this makes the most of Copilot's iterative nature. Once you know exactly what you want, the more details you can give the better. Other tips? Using quotation marks if there's something specific you want Copilot to deal with, and simply be as clear as possible.

It's also worth noting what you shouldn't do. Being vague is likely to be your biggest problem at first, but you should also avoid any jargon

or slang words. Finally, remember that Copilot is expecting your follow-up question to relate to what came before. If you want to start a new topic, write “New task”.

But we know what the real question you want to ask is: how good are the Copilot implementations in the Office apps? And that's what the rest of this article seeks to answer.

COPILOT PRO FOR POWERPOINT

There's little sign of actual intelligence here, but it's useful for improving existing documents

SCORE ★★★★

If you want an example of what not to use Copilot for in PowerPoint, then I have just the thing.

AN AI PRESENTATION

WELCOME TO THE BATTLE

ARM

- ARM is a major player in the mobile CPU industry
- The company was founded in 1990
- ARM licenses its technology to other companies

Intel

- Intel is a leader in the CPU industry
- The company was founded in 1968
- Intel is best known for its x86 processors

AMD

- AMD is Intel's biggest competitor
- The company was founded in 1969
- AMD is known for its Ryzen processors

Qualcomm

- Qualcomm is a leading mobile CPU manufacturer
- The company was founded in 1985
- Qualcomm is known for its Snapdragon processors

The Future of CPUs

- The CPU industry is constantly evolving
- New technologies are emerging
- Competition will continue to be fierce

COPilot PRO FOR WORD

A handy companion that can do the basics, but it won't turn you into a wordsmith

SCORE ★★★★☆

 Copilot has three main uses in Word: creating a draft for either an entire document or for sections of it, based on a prompt of up to 2,000 characters; rewriting selected text according to a prompt; and answering questions about a document's content, including summarising it.

When you create a new document in Word, you'll see how much Microsoft wants you to draft using Copilot: it's the first thing you see. And any time you make a new paragraph, the Copilot icon shows up in the left margin, letting you input a prompt to write a new section. If you select text, the icon shows up with an option to rewrite the selection. There's also a Copilot icon in the Home toolbar, which opens a sidebar so you can ask questions about the open document, summarise it, or write additional parts.

The output quality of any big language model depends on the prompt you provide. If you aren't specific or clear enough, Copilot Pro will produce dull texts that don't match your voice. You must give sufficient details and context for it to understand your purpose and style, as well as information about the preferences of the audience, all of which can be tricky in a prompt limited to 2,000 characters.

Occasionally, it's vague, drifts off-topic, or entirely ignores explicit instructions – for example, about word counts or facts you have told it to include. You must check and edit the texts that Copilot Pro writes to make sure they're right for your goal and audience.

Copilot has its own little linguistic ticks, which you will probably need to be explicit about in prompts. It absolutely adores bullet-pointed lists, and will include them every time unless you tell it not



ABOVE Copilot for Word works best if you ask it to create an outline rather than an entire document

to. Similarly, and likely reflecting the web content on which it's trained, it loves to include "hints and tips" sections in virtually every kind of content.

Rewriting is also erratic. Although its grammar is impeccable (albeit with a penchant for the Oxford comma and American spellings), Copilot won't catch and fix all the problems in your paragraphs; think coherence, structure and flow. It's no replacement for a dedicated tool such as Grammarly or LanguageTool. I even found that Copilot added in things that Microsoft Editor thought were errors.

Copilot can still be handy in Word if you use it for what it's good at. For example, instead of making it write a whole document, ask it to create an outline for you to work. This delivers solid results, and if nothing else avoids the blank sheet of paper issue.

I also found it handy to keep the sidebar open when working on a long piece; in one case, I needed to make sure that every chapter included a call to action at the end, and that's something Copilot is great at. It's also handy for those moments when you want to get suggestions for something, whether that's as trivial as looking for an antonym or as complex as "give me five typical Russian male first names, popular in the 1950s".

Considering that this is Microsoft's first stab at Copilot for Word, it's an impressive piece of work. **IAN BETTERIDGE**

You might think that asking Copilot Pro to "create a presentation about Copilot Pro in PowerPoint" would be an easy win for the AI. You would think wrong: instead, it came up with a presentation about a fictitious piece of software that appears to combine advanced aircraft flight planning with a collision avoidance system – which it illustrated with a picture of a car.

Of all the Office applications, PowerPoint probably benefits least from Copilot Pro when it comes to

BELow Stick to the preset prompts, and the PowerPoint tool works well

creating documents from scratch. This is down to it not having one of the key features that business users of Copilot get: the ability to take a Word document and turn it into a PowerPoint deck. PowerPoint is, fundamentally, an application for taking information and presenting it in a visual format, and a 2,000-character prompt just isn't enough for anything except the shortest presentations.

What Copilot is good for, though, is taking an existing deck and improving it. If you don't like a visual being on the left-hand side of a slide, you can just ask Copilot to move it to the right – although you also need to tell it to move whatever is already on the right to the left, too, if you don't want a visual pile-up to ensue. Similarly, asking it to change the headline font on all slides to, say, Constantia – and it makes the changes in seconds – feels magical.

Wisely, Microsoft includes a set of pre-made prompts to get you started



with the kind of things that Copilot is good at. For example, it can scan a deck for deadlines and list them all out, helping you avoid that moment when you realise you have combined two people's work and got entirely different deadlines for a project in them. Stick to the preset prompts at first, and Copilot Pro in PowerPoint is a useful tool. **IAN BETTERIDGE**

COPilot PRO FOR EXCEL

The surprise hit of the package, Copilot Pro for Excel is a great tool for less savvy users

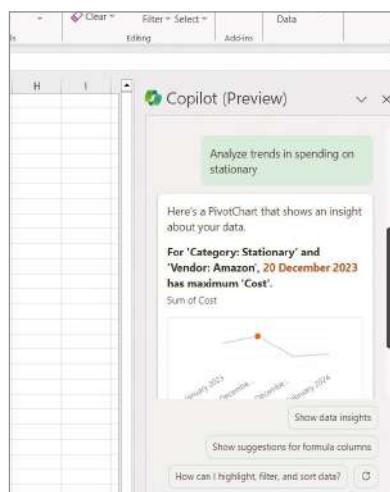
SCORE ★★★★☆



Unlike the other Copilot Pro tools, Copilot for Excel is labelled prominently as "beta". But even in this qualified state, it has the promise of being a game-changer for anyone who needs to work with data but doesn't want to become an expert in writing formulas, working out the best way to pivot data or spotting trends in large data sets.

Copilot for Excel exists in the toolbar, but sometimes it's greyed out. That's because it only works on .xlsx or .xlsm files saved in OneDrive or SharePoint. When the button is green, hitting it allows you to write natural language instructions to create formulas, analyse data or highlight cells according to whatever criteria you want. If you've ever struggled with creating a complex formula (or even a simple one), you're going to love it.

The first thing to note is that Copilot only works within tables; if your data is unstructured, it won't let you do anything with it. This probably isn't a big deal for most people (every serious Excel user I have known has lived or died by tables), but it's a



ABOVE Copilot could make working with Excel data far easier for non-experts





limitation that may affect some users of large and disparate data sets.

If your data is in a table, though, Copilot is miraculous. You can ask simple queries, such as how much you spent between two dates, or what categories you spend the most on. It's also great at creating graphs: just type, "make a pie chart showing expenditure based on month". And you can manipulate existing data, say by asking it to use conditional formatting to highlight specific ranges of numbers, something that's easy to get wrong for people who aren't Excel experts.

You can also use Copilot to look for outliers in the data and highlight them, which helps if you're trying to clean up a dataset or are finding results just aren't what you think they should be. If you're using a big dataset, that's a wonderful time saver. It's nothing that you can't do with Excel's existing tools – but for users who don't live in Excel, it would involve quite a bit of searching online to know where to start.

Where the real power kicks in is when you ask it to make formulas for you. I created a simple table of expenditure for a small business, tracking spending across a range of categories. But I also wanted to have a column indicating the running total of my expenditure. This isn't an easy formula to make if you don't know much about Excel because it involves a SUMIF function that's based on the row's date, comparing it to others in the table.

ABOVE Choose the tone of your AI-generated emails carefully

I asked Copilot to "add formula columns to summarise total expenditure so far in this date sequence", and within seconds it had created a formula and added it to the end of the table.

This kind of formula creation is going to save users of Excel hours, and if you regularly work with data but wouldn't call yourself an expert, it's probably worth the money on its own. Even on occasions where I wanted to do something that I knew how to do, I found myself using Copilot instead because it created better results than the various hacks, shortcuts and cheats that I have learned over the years. **IAN BETTERIDGE**

COPILOT PRO FOR OUTLOOK

Of greatest use to people who are sent long, rambling emails or struggle to compose quick replies

SCORE

There are three key features in Copilot for Outlook: summarisation, drafting and coaching. Summarisation is probably the feature you'll encounter first, as every email you receive has a prominent "Summary by Copilot" bar at the top.

Click on this, and it creates a short, easy-to-read summary of the key points in the email. How useful this will be depends on the kind of mail you get. But if you spend a long time reading complex emails and trying to work out what the point is, you'll love it.

The second main feature, drafting, is like the drafting feature in Word, in that you give it a prompt and it writes the email for you. You can vary the tone using pop-up options – direct, neutral, casual, formal or, erm, "make it a poem" – and set the length as short, medium or long. Beware: Outlook uses the last tone you selected, so if you do decide to write a poem, remember to change it before drafting an email to your accountant.

As with Word, I'd categorise the results as "something to start with and personalise" rather than the finished article. Tonally, it veers towards the extreme: formal is *very* formal, and casual is probably fine for sending to family and close friends only. In my tests, direct produced the best results, although some of its phrases required toning down to stop them sounding like the kind of email you get from the bailiffs chasing you for a late payment.

My favourite feature is coaching. This checks the content of an email you've written and gives you tips on

DOES YOUR BUSINESS QUALIFY FOR FREE FASTTRACK SUPPORT?

When Microsoft announced the general availability of Copilot for Microsoft 365 in January, it also removed all limitations on rollout sizes. Up until that point, you needed to commit to 300 seats for a minimum of a year. At £24.70 exc VAT per user per month – on top of the cost of Office 365 itself, which is a minimum of £22 exc VAT per user per month for the E3 version – that added up to a £108K investment over the course of a year. Minimum.

The sweetener to that deal is that companies received direct support from Microsoft via its FastTrack experts. And now that offer extends to companies with 150 paid-for Office 365 (or Microsoft 365) licences. If, that is, you fulfil four other criteria.

The first is easy: you must already use the

RIGHT "Teams-ready" businesses may be able to access free support

Office apps. The second is that you are "Teams ready", which here means that you share content in meetings (such as Word docs) and hold meetings with at least three people in attendance.

The third is trickier: that you must commit to monthly channel refreshes of Office software. Many businesses prefer the six-monthly refresh, as this gives them time to test line-of-business software. Switching to a monthly refresh obviously comes with extra hassle and potentially extra costs.

Microsoft's final criterion revolves around labelling. You must either have an existing MIP labelling policy (MIP stands for Microsoft

Information Protection and relates to labelling around Azure data) or have your own labelling policies in place. If you fulfil those criteria, get in touch with Microsoft directly.



COPILOT FOR TEAMS

A brilliant personal assistant for meetings, but don't let it replace your critical thinking skills

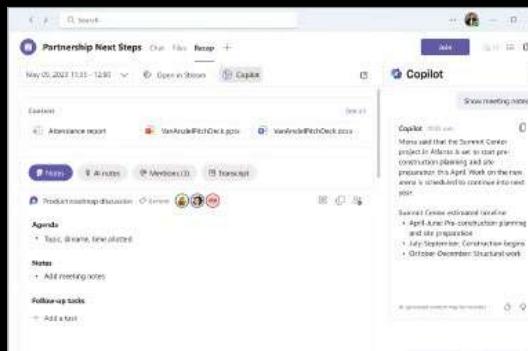
SCORE ★★★★★

T Long before the arrival of Copilot, Microsoft Teams became my go-to app that was always active on my desktop. It's the central tool I use to stay updated about my organisation's activities and it's where I plan my daily tasks, share content, have meetings and plan long-term goals. Now Microsoft has added Copilot, it has become even more indispensable.

This is most obvious in meetings. The responsibility of capturing important meeting details typically rests on a single person, a task that's rarely enviable and often challenging. Even with transcription features enabled in Teams, sifting through conversations to find pertinent information was daunting. This is an area where Copilot excels, making it easy to summarise the discussion and draw up action points.

I also find it useful within meetings, especially long ones that drag on, when your attention can wander. If I briefly zone out, or I need to head off for any reason, Copilot can offer summaries at any juncture. If you arrive late, or simply don't get to the meeting at all, being able to ask Copilot for a summary of the meeting with the key action points and follow-up tasks is a huge boon. As is its ability to revisit discussions and extract insights.

This isn't just theory. Over the past six months I've asked Copilot to pinpoint staff disagreements,



outline specific risks discussed, verify project timelines and summarise crucial decisions with pros and cons. Using Copilot for these kinds of enquiries saves time by reducing the need to consult busy colleagues, delivering on two fundamental promises of AI: it streamlines communication and enhances my efficiency.

Copilot packs in several other useful features, too. Managers may love (a little too much, perhaps) its ability to analyse participation in meetings by generating metrics showing the percentage of words spoken by each colleague, shedding light on both the most and least active participants. And one standout feature in Teams Premium, not available in the standard version, is the intelligent meeting recap. It parallels Copilot's meeting notes and holds the information for 30 days. The "follow meeting" function in Teams Premium allows users to capture meetings, pose questions to Copilot post-event, and even analyse the sentiment, although this yields mixed results and is a little creepy.

how to improve it, with clear advice that's actually useful. It advised me to make my tone more confident, which professional writing coaches have told me in the past. **IAN BETTERIDGE**

COPILOT PRO FOR ONENOTE

Don't expect anything radical, but this is a handy enhancement for inveterate note-takers

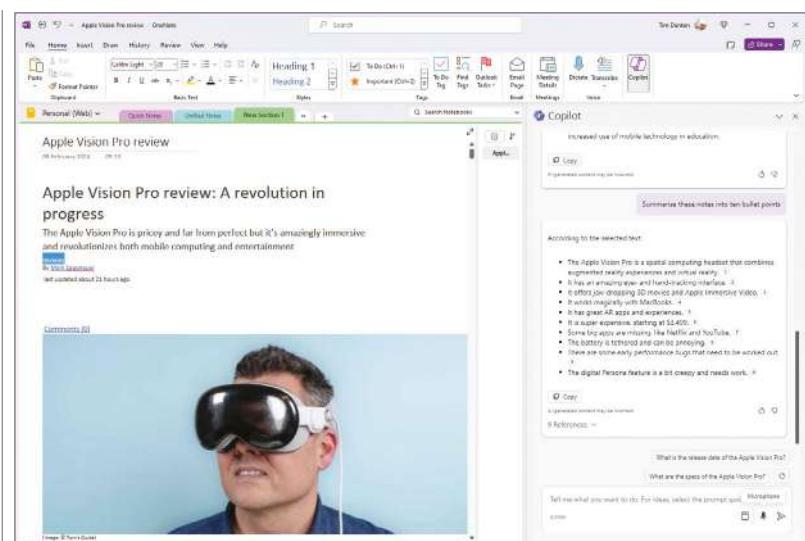
SCORE ★★★★★

N It could be because I tried Copilot in OneNote after all the other apps. It could be a because I'm not a regular OneNote user. Or it could be that this is indeed a, "oh, I suppose we should add it to OneNote as well" kind of effort.

Copilot appears in OneNote the same way as most other apps: as a button in the Home ribbon. You can do all the things you'd expect, such as summarising meeting notes and creating action points. But where in Teams it feels powerful and integrated, here it feels like an add-on.

For example, I hoped that it would tie in with the transcription option,

RIGHT Copilot for OneNote is ideal for creating action points, but little else



perhaps creating a rival to Otter.ai that not only delivered the notes but gave me something extra, such as sentiment analysis. But no, it couldn't even remove the timestamps from the text when I accidentally kept them in.

You'll also need to be careful about where you file notes, as Copilot has some difficulty discerning between the active note and all the ones filed within a project. Mind you, the fact

LEFT Copilot for Teams is a genuinely beneficial use of AI in the workplace

Copilot in Teams can also save you time. It adeptly transforms meeting notes into Office 365 documents and drafts emails from discussions. And it uses Microsoft Graph to efficiently link and track communications across documents, meetings and chats on specific subjects. This is great if your memory isn't too good, so this is my favourite feature.

As Microsoft states, however, "Copilot is an assistant, not a replacement for human oversight". It's crucial that you review Copilot's output, particularly when it pertains to significant decisions, to ensure accuracy and relevance. So while Copilot boosts efficiency, there is a risk that users may become too dependent on the tool, which could lead to a decline in critical thinking and problem-solving abilities.

Finally, in organisations where security is paramount, outputs generated by Copilot don't automatically carry over the security classifications of the original files. This poses a significant risk when dealing with sensitive information. Consequently, it becomes the responsibility of the employee to meticulously review the AI-generated content to confirm that the data is correctly classified and evaluated for potential risks.

To misquote a certain masked superhero, with great AI power comes great responsibility to check its results. **ADAM TIMBERLEY**

that it can work across a bunch of collated notes has its advantages, too.

Copilot in OneNote performed best when working with my scrawled notes from a meeting, deducing that when I wrote some names next to "Who?" that these were indeed the people involved.

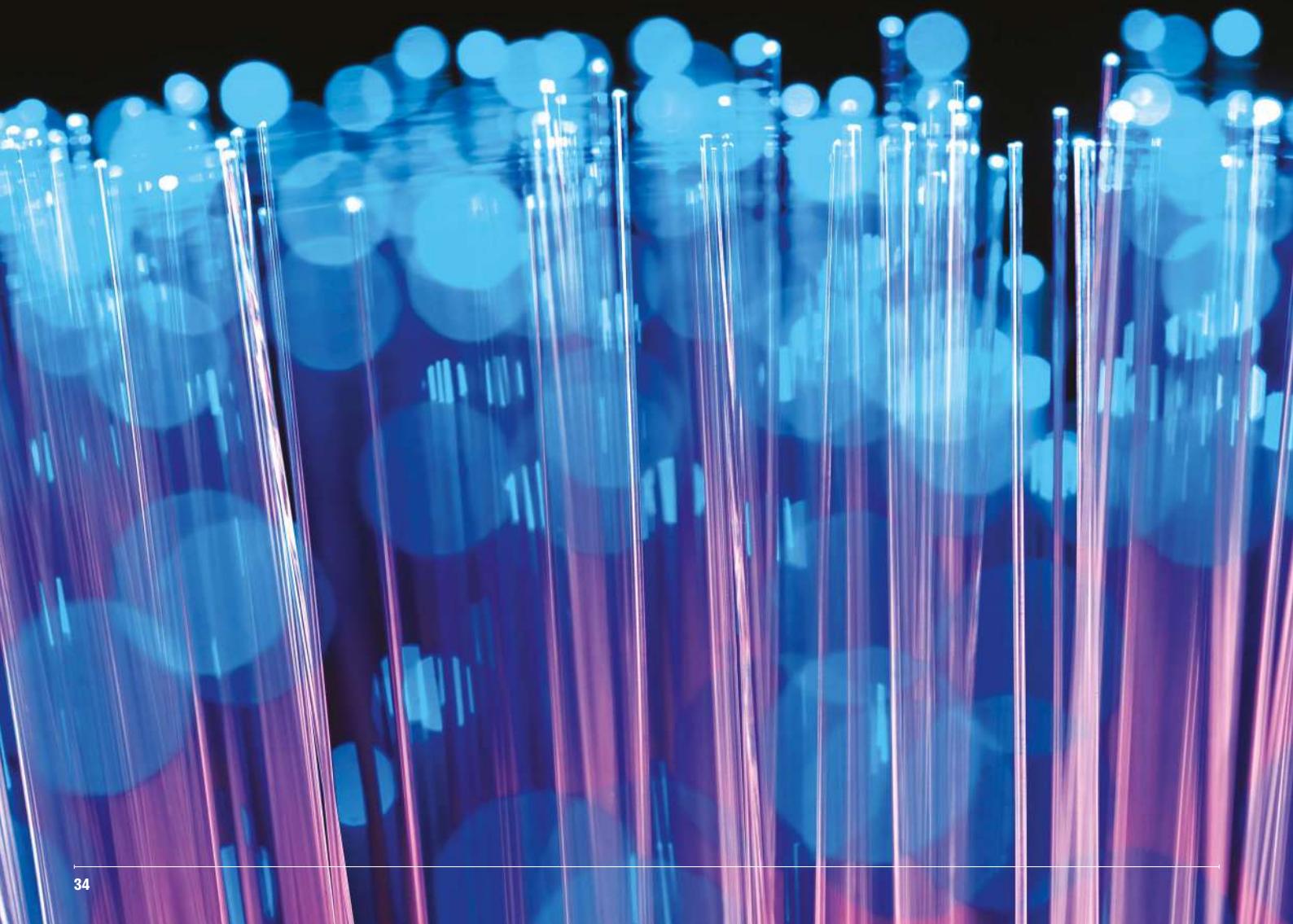
If you're a OneNote fan then you'll probably like what Copilot Pro can do. But I can't see this making any new converts. **TIM DANTON**



THE GIGABIT BROADBAND GAMBLE

There are dozens of altnets offering gigabit broadband at unbelievable prices. But is the market about to come crashing down?

Barry Collins investigates



The past few years have been boom times for British broadband customers. More than a hundred smaller fibre providers – so-called “altnets” – have sprung up across the country, installing fibre-to-the-premises and offering it to new customers at knock-down rates. Symmetrical gigabit broadband for £25 per month? Where do I sign?

The emergence of the altnets, combined with expanding fibre networks from both Openreach and Virgin Media, have rapidly enlarged the UK’s fibre footprint. The majority (57%) of British homes now have access to full-fibre, according to Ofcom figures published in December, covering 17 million homes. That’s up from 42% of homes only a year before.

However, the boom may be coming to an end. Having burned through their venture capital funding, many altnets are now focusing on getting customers to use the fibre broadband that passes by their door instead of expanding their networks further.

There’s also a widespread industry expectation that the number of altnets is going to decrease as quickly as it rose over the past few years, with consolidation in the market. Some are predicting that those 100+ altnets could eventually reduce to only one, much as the various cable networks that sprung up in the 1990s were gradually whittled down to only Virgin Media.

Sign up for a two-year deal with an alnet now and there’s a chance you could be the customer of a much bigger network before the contract expires, as the bigger fish look to gobble up smaller rivals so they can compete against Openreach and Virgin Media.

Is it worth taking a gigabit gamble on a smaller provider that might not even be around in a couple of years’ time? Let’s explore how the fibre broadband market is expected to shake down, along with the benefits and risks of signing up with one of Britain’s many altnets.

The broadband boom

It may have taken a while to get going, but the UK is now well on its way to becoming fully fibred. And, thanks in part to the emergence of many rural altnets, the whole of the UK is (with some notable exceptions) benefitting.

Northern Ireland has been the standout leader of the four UK countries. More than nine out of ten homes in Northern Ireland are now within reach of a full-fibre network, including 82% of rural homes, according to Ofcom’s Connected Nations report published in December. Both urban and rural fibre are significantly lower in England,

Is it worth taking a gamble on a small provider that might not be around in a couple of years?



Scotland and Wales, but full-fibre is available to more than half of homes in each of those three countries. With the possible exception of areas in Scotland, where only 32% of rural premises have access to full-fibre, nowhere is being left behind.

One reason why altnets and the bigger wholesalers are willing to take a punt on the more expensive-to-reach rural areas is because take-up is so much better. “Of premises with access to full fibre, 49% of premises in rural areas have taken full-fibre, compared to 25% in urban areas,” Ofcom reports.

Businesses aren’t being left out, either, particularly small to medium-sized enterprises. By September last year, over half of SMEs in the UK had access to full-fibre networks, with roughly the same urban/rural split as there is in the domestic market.

In fact, when you look at “gigabit-capable” lines – including connections that can reach gigabit speeds on the hybrid coaxial cable lines operated by Virgin – the figures are much healthier: 78% across the entire UK, with Wales containing the lowest proportion of gigabit-capable lines at 64% of the population.

All in all, the picture is looking strong, although we shouldn’t forget the 61,000 premises that Ofcom says can’t receive “decent broadband” (at least 10Mbit/sec). Even there, services such as Starlink’s satellite broadband (see p38) are stepping in for many. Starlink has 42,000 UK customers, according to Ofcom, up from 13,000 in 2022.

End of the growth spurt?

While the surge in fibre installations has been welcome, there are signs that

ABOVE Belfast-er: Northern Ireland is leading the way in full-fibre networks

the growth spurt may be slowing. Many of the altnets began life in better economic conditions, when interest rates were low and venture capital to finance the expensive business of building the network was easier to come by. Those days are gone.

The altnets have spent the past couple of years “burning through venture capital money, where you’re trying to build really fast,” according to Andrew Ferguson, editor-in-chief of **Thinkbroadband.com**. “Now the focus has moved to actually getting people to sign up.”

Instead, he believes many of the altnets will be spending the foreseeable future trying to reduce the losses they’re making. “You may not make a profit, but the amount you lose per quarter will be a lot less,” he said, making the business more attractive to potential buyers.



But even if the altnets aren't building at the rate they once were, Openreach is still keeping its foot on the accelerator. The networking arm of the BT Group aims to reach 25 million homes by 2026, and says it will add another four million premises to the full-fibre footprint in 2024 alone.

"Our primary focus is, and will continue to be, on delivering our own strategy which, in a nutshell, is to build a nationwide high-quality full-fibre network to serve the UK's homes and businesses and to build it right across the UK," Richard Allwood, managing director for strategy at Openreach told us.

Virgin Media is also continuing to expand its fibre network, with plans to add five million new homes by 2026. And then, two days before this magazine was going to press, Virgin Media announced plans to offer wholesale access to its network, meaning other ISPs will soon be able to sell services on Virgin's lines, just as they do currently on Openreach.

Then there's the biggest altnet of all, CityFibre. The company wants to reach eight million premises by the end of 2025, although it's currently only passing 3.4m homes. How is it going to reach that ambitious target in under two years? "There are lots of different ways we could get to eight million," CityFibre's chief marketing officer, Dan Ramsay, told Zen Internet CEO Richard Tang in a recent podcast for the broadband provider.

"We could get there through our own entire build programme," he said, although that would mean doubling the company's current 100,000-a-month building rate. "We could get there through acquisition, we could get there through a combination of both build and acquisition."

Gobbling up some of those other altnets is definitely high on the agenda for CityFibre. "We've been quite public about our ambitions when it comes to acquisitions," he told Zen Internet's podcast. "It's not a surprise to see that the market was going to consolidate at some stage. I suspect we're on the cusp of some of that consolidation now in early 2024. There are lots of altnets out there... and lots of those are probably going to struggle to be viable opportunities for ever, and that gives us some rich opportunities."

100 to 1?

In fact, CityFibre isn't only looking to acquire a handful of altnets – it seemingly has ambitions to own them all. Ramsay predicts a repeat of the cable market in the 1990s. "The cable consolidation, which has ultimately ended up at Virgin Media's door, was a lot of small, local cable companies all

The altnet difference

To give you some examples of how altnet deals compare to those from the more established providers, we've picked a selection of locations from across the UK and compared the tariffs on offer. As you can see, sometimes altnets are

competitive on price, at other times on speed, sometimes both. In each case, we've picked the fastest tariff on offer from the provider at a specific postcode on a 24-month deal, unless otherwise stated. Altnets are highlighted in green.

Horsham, West Sussex

Provider	Box Broadband	Hey! Broadband	Bt Broadband
Average download speed	850Mbps/sec	900Mbps/sec	900Mbps/sec
Average upload speed	850Mbps/sec	900Mbps/sec	110Mbps/sec
Price per month	£25	£25	£47

Selkirk, Scottish Borders

Provider	Go Fibre	Bt Broadband	Now Broadband
Average download speed	900Mbps/sec	16Mbps/sec	11Mbps/sec
Average upload speed	100Mbps/sec	1Mbps/sec	1Mbps/sec
Price per month	£69	£30	£20

Omagh, County Tyrone

Provider	Fibrus	TalkTalk	Virgin Media
Average download speed	982Mbps/sec	944Mbps/sec	1,130Mbps/sec
Average upload speed	310Mbps/sec	110Mbps/sec	104Mbps/sec
Price per month	£40 (18 months)	£49 (18 months)	£42 (18 months)

Milford Haven, Pembrokeshire

Provider	Ogi	Sky	Vodafone
Average download speed	900Mbps/sec	61Mbps/sec	67Mbps/sec
Average upload speed	90Mbps/sec	13Mbps/sec	13Mbps/sec
Price per month	£30	£27	£24

There are lots of altnets out there... and lots of those are probably going to struggle to be viable opportunities for ever, and that gives us some rich opportunities.



coming together that took three or four years before it really shook out into a predictable pattern," he told Zen's podcast, adding that the altnet consolidation will probably take a similar period of time.

"We won't end up at the end of this with Openreach, Virgin Media plus five others," he added. "We will end up with probably three [in total]. We certainly see ourselves at CityFibre, as the biggest altnet by some distance, as being the acquirer, not the acquiree [sic], and leading that charge." It's worth noting these remarks were made before Virgin announced plans to wholesale its network.

CityFibre certainly won't be getting into any bidding wars with Openreach, which insists it's focused on building its own network, not buying other providers'. "We're 100% focused on our organic strategy and ramping to a rate of reaching four



million premises per year," said Allwood. "We're currently reaching around 73,000 new premises every week, so finding the time and resources to acquire then integrate an altnet would be a major and unwanted distraction."

So does that mean the altnets are there for CityFibre's taking? Others aren't so sure. "I think that's an unlikely scenario," said Thinkbroadband's Andrew Ferguson. He believes altnets such as B4RN, which serve rural communities, are unlikely to sell out. He believes CityFibre's bullish interview was a statement to say "look, we're not going anywhere, our plan is to be the big incumbent".

"They are an altnet," Ferguson said of CityFibre, "but I think they would prefer it if we didn't talk about them as an altnet. If they were talked about in the same breath as Openreach and Virgin Media, they'd be a lot a happier."

Zen Internet's CEO Richard Tang agrees that a big consolidation is coming, but he too is sceptical about whether we will end up with only three wholesale fibre networks. "I'm pretty sure that CityFibre themselves are talking to lots of others about potential mergers and acquisitions," he told PC Pro. "But... even if the money's there, coming up with the deal that works for everyone is far from straightforward."

He thinks it could be past the end of the decade before the consolidation of the altnets is complete. "Will it be just one [left]? Difficult to say. There's not much room for more than about two or three, for sure," Tang added.

Why, if more than a hundred exist today, is there only room for two or three altnets? Pure economics. There are only around 30 million homes and offices in the UK, and Openreach plans to reach 25 million of them by the end of next year, and keep building. Once Openreach (and potentially Virgin) has marched on to your patch, you're not only competing with BT Broadband, but Sky, TalkTalk, Zen Internet and all of the other

ABOVE Openreach is aiming to connect four million premises per year

established ISPs who wholesale off Openreach. That, as Richard Tang explains, poses huge challenges for a small, localised altnet. "It's this scale problem of running an ISP and a fibre network with 10,000 customers or something," he said. "It's just too difficult. There are too many things you need to do for too few customers."

(See "The alternative view", right, for one altnet's take on why there's a future for some altnets.)

Weighing up the risk

This leaves broadband consumers with a dilemma. As we mentioned earlier, many altnets are now focused on ramping up the number of customers on their networks, and that means there are lots of great deals to be found. It's highly likely you'll get a better price from an altnet that's recently moved into your area than from one of the more established ISPs and, in many cases, better speeds (see box, opposite).

But there's an element of risk here, too. If the market does consolidate as everyone expects, then there's every chance that the altnet you sign up with could be bought by another company. That brings uncertainty, the potential for disruption during the migration process to the new owner, and the possibility that the great deal you signed up for won't be available by the time you come to renew your contract.

We've already seen this start to happen with some providers. In January, customers of altnet provider Upp, which was bought by nexfibre in 2023, were told their services would be switched to Virgin Media some time in 2024. That's the same Virgin Media that recently topped Ofcom's latest quarterly broadband complaints table, with almost twice as many complaints about its service than the next worst provider. Although Upp customers will likely be able to cancel their contract without penalty, there

The alternative view

Will the 100+ altnets eventually boil down to only one? Not according to the CEO of altnet GoFibre, whose company is delivering full-fibre services to customers in the north of England and Scotland. Neil Conaghan agrees that market consolidation is inevitable, but that there's still space for a number of altnets to compete long-term with Openreach and Virgin Media.

He believes there are two main factors that are driving consolidation. "There are lots of places where there is already too much altnet competition," he said. "So, you have got consolidation to remove competition out of the market and to take excess cost out of the industry as a whole."

The second big factor is consolidation itself – smaller networks are coming together because they don't want to be left out of the frame when the bigger networks start shopping around. "There's a received wisdom that you need to have something in the order of 500,000 ready-for-service homes to be a meaningful size and a meaningful participant in consolidation.

"People don't want to be the tail-end Charlie," he added.

But that doesn't mean there's not a future for a strong, independent network – even if Openreach eventually turns up in the areas that it already covers, according to Conaghan. "It is still possible to make a good business out of a two-player market," he said.

But it's not just a two-player battle when Openreach turns up – Openreach wholesales its network to huge household names such as Sky, TalkTalk and, of course, BT/EE. How does a smaller network take on the big beasts in the long run? By being different, according to Conaghan. "We position ourselves differently," he said. "We provide local customer service. We are we're very much positioned as hyperlocal. We are very active in the communities where we are present."

That includes a "Go Further Fund" where GoFibre provides funding for local charities that are also active in the local communities. The challenge of competing against Openreach and national ISPs is "very, very, very well understood," Conaghan added. "The way that we do business is different."

"That still doesn't mean it's going to be easy; it's never going to be easy," he said. "But I think we've got an interesting proposition and our customers seem to be in agreement with that at the moment. We have a very fast-growing customer base and a good trajectory going into 2024. I'm feeling pretty good about it."

GoFibre's digging



GoFibre CEO Neil Conaghan believes altnets have a role to play if they differentiate themselves from the big players



may not be another provider in their area that offers equivalent speeds.

Even if you're happy to stay with a new owner, there's the risk of inconvenience and service disruption as the new owner migrates customers to its network, its billing system, its monitoring systems. Andrew Ferguson believes the risk of service disruption is low, with the major problems likely to be different equipment being used for remote access, diagnostics and monitoring that the new owner would want to standardise on its existing kit. The new owner "may want to swap them over but that's the sort of thing you can do in time and then fit into general maintenance," he said.

Openreach thinks it's more of a challenge, which is one reason why it prefers to overbuild rather than acquire altnets. "Integration is always difficult," said Allwood. "Different companies will typically use different technologies and vendors for their networks and systems. That will take time and cost money to integrate – it's often underestimated in the M&A [mergers and acquisitions] process."

Yet, even given the potential for disruption or falling into the hands of an unattractive new owner, Ferguson said he would still be willing to take a gamble on an altnet offering a good deal. He said a new owner would be unlikely to impose a mid-contract price hike. "The chances are that the people who will acquire you will want to keep you as a customer anyway, so they probably won't do anything to upset you until the end of the 24-month [contract] period," he said. "So, you're likely to be pretty safe."

That said, there are some too-good-to-be-true deals that a new owner might turn away. Ferguson cites the example of the first customer in a town being given a free connection for life as a publicity stunt. "Those ones might [be cancelled]," he said, "but those sorts of offers are not common."

ABOVE Former PM Boris Johnson on a visit to CityFibre

STOP PRESS

Just before this magazine went to press, both Virgin Media and Openreach announced big speed increases on their networks.

Virgin Media will now offer symmetrical 2Gbits/sec connections to one million of its customers initially. Openreach, meanwhile, is increasing its top download speed to 1.8Gbits/sec.

Starlink

Rural internet users rejoice – fast internet is now available for a fair price

SCORE ★★★★☆

PRICE £374 (£449 inc VAT) for hardware, £63 (£75 inc VAT) per month for service from starlink.com

If you can't access high-speed internet via the usual means, Elon Musk's Starlink is now available across the UK. Having experienced repeated issues with traditional broadband in my rural setting, I recently signed up to the company's Personal service for £75 inc VAT per month, which offers unlimited data subject to a "fair use" policy.

It appears that you don't need to be concerned about this policy. After one month and downloading nearly 400GB of data, I experienced no issues. However, this may be because I use a VPN on all my devices, encrypting traffic so Starlink can't distinguish specific content such as streaming video.

The Personal service gives expected performance of around 25 to 100Mbits/sec for downloads, uploads of 5-10Mbits/sec and latency of 25 to 60ms. However, power users and businesses are encouraged to pay for the Business service, which offers 40GB of "Priority" speeds. Latency is no different, but this boosts expected download speeds to 40 to 220Mbits/sec and uploads to 8 to 25Mbits/sec.

The other caveat when signing up is hardware costs. The list price is £449 but refurb models are available at the time of writing for £199. Or you can choose to rent the hardware for a very reasonable £10 per month. You may also want to buy an official Ethernet adapter, as the supplied Starlink router has no Ethernet port of its own.

The package includes the satellite "dish", a 23m connecting cable, a 3m power cable for the router and the router itself. Setup is handled by an app, which walks you through the process. The app's "obstructions" tool scans the sky to check if there's anything in the way of the dish receiving signals from SpaceX's low Earth orbit satellites.

It took me less than ten minutes to unbox the Starlink hardware and get

online, but I already had an outside power socket and there was a vacant satellite mount on my roof. Starlink sells a standalone "pipe mount" and various wall/roof mounting kits for those less fortunate.

The other issue concerns the router. It's difficult to store this outside safely, so unless you're very comfortable with DIY, you'll need to hire someone to come and drill holes in the wall to stow the router safely inside while still connected to the dish.

So, what of performance? Starlink warns that connection speeds can vary depending on factors such as the placement of your dish, the number of people using the service at the same time and your chosen activity. To minimise network congestion, I ran my tests at around 11pm using the Starlink app running on an iPhone 14 Max Pro. The "Starlink Speed" for downloads was 71Mbits/sec, with uploads of 15Mbits/sec. That's consistent with Starlink's claims.

After spending some weeks with Starlink, I can say I'm delighted with the Personal plan. In many cases it works out to be more cost effective than using mobile broadband. My downloads compare favourably to fixed-line internet in my particular area, I've hit no latency issues and I'm a big fan of hardware rental, as previously the upfront cost of buying the dish, mount and router was a huge hurdle.

The only warning I'd offer is that you'll probably need some additional hardware and expertise to install the satellite dish permanently (although I discovered some people using workarounds such as zip cables to attach the dish to the top of a tree). While Starlink subscriptions come with a 30-day free trial and you can cancel your subscription at any time, it makes sense to think through the logistics before you sign up. **NATE DRAKE**



LEFT The Starlink dish is fairly easy to install if you already have a satellite mount on your roof

Don't bury your head

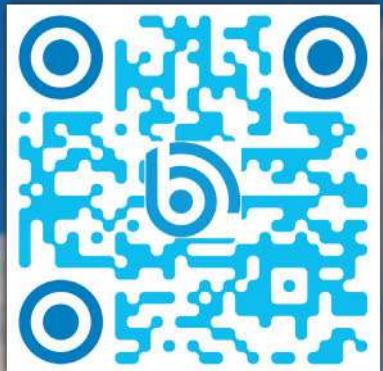
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CREATE YOUR OWN WI-FI HEATMAP

Does inconsistent Wi-Fi have you roaming around your home or office in search of a decent signal? Darien Graham-Smith reveals how to get a clear, complete and colourful picture of your wireless coverage

Patchy Wi-Fi is the bane of many households. You can pay considerable sums for a router with the latest technology, only to find that half of your home still gets iffy service.

If you want to improve matters, the first step is to identify exactly where your wireless coverage is strong and where it's lagging. Professional network architects approach this sort of job by creating a heatmap of wireless signal strength across a business' premises, revealing any areas of uneven coverage and potential locations where additional transmitters may be required. Here's how to do the same for your own home, entirely for free.

YOUR FIRST HEATMAP

You can create a simple heatmap using just a piece of paper, a pen and a smartphone or laptop. All you need to do is sketch out a floorplan of your home, then walk around it in real life, checking the reported signal strength of your wireless network as you go, and noting down your findings in the appropriate locations on the map.

The only catch is that most devices won't show you detailed information about your wireless signal; you'll

have to install an app to access this technical data. One free option for Android is WiFi Analyser & Heatmap, available on Google Play from a developer called Webprovider.

This opens with a graphical display of visible networks; tap the 5GHz icon at the top right of the screen (assuming that's the band you're interested in), then tap the three-dots menu next to it and select "List". You'll now see details of all nearby networks, with a signal strength reading in dBm next to each one, plus a potentially useful rating of low, medium or high interference.

iOS users can get similar information from Apple's Airport Utility app, available as a free download from the App Store.

In Windows, the Wi-Fi icon in the system tray gives a broad representation of signal strength (depending on how many bars are solid black), but you can get a much more precise reading by opening a Command Prompt and typing `netsh wlan show interfaces`. This will return a list of technical statistics about your connection, including signal strength as a percentage.

For convenience, you could create a simple batch file that spews out a

continual live reading, so you can just glance down at the screen to check the signal strength as you wander around:

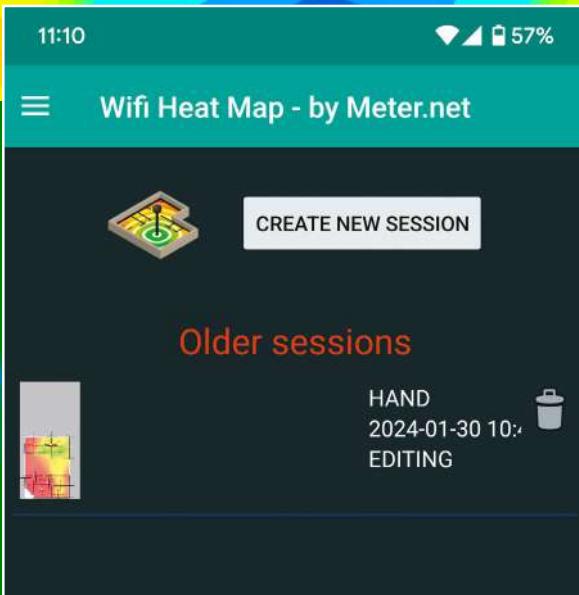
```
echo off  
:start  
netsh wlan show interfaces | findstr  
Signal  
goto start
```

The "goto" command is unfashionable these days, but it's the simplest way to achieve our goal. We also haven't bothered writing a clean exit routine: just hit Ctrl+C to quit the script when you've got all the data you need.

HEATMAP SOFTWARE

A pen-and-paper heatmap might well convey all the information you need, but if you want to generate a more sophisticated digital heatmap, with nice bright colours to represent signal strength, there are plenty of tools that can help. While some are aimed at networking professionals and are priced accordingly, there are also free tools for all the major platforms that will do fine for a basic home survey.

For now we'll focus on an Android app called Wifi Heat Map - Survey,



YOU CAN CREATE A SIMPLE HEATMAP USING JUST A PIECE OF PAPER, A PEN AND A SMARTPHONE OR LAPTOP

UNDERSTANDING THE NUMBERS

The Heat Map app reports your Wi-Fi signal strength in negative numbers, typically ranging from around -80 to -40. This may seem rather arbitrary, but there is a logic to it. The measurements are in decibel-milliwatts (dBm), where 0dBm means the strength of the received signal is equivalent to one milliwatt of power. The scale is logarithmic, so -10dBm represents 0.1mW of power, -20dBm represents 0.01mW and so forth.

The dBm scale itself has no upper or lower limit, but most Wi-Fi gear has a maximum radio transmission power of -30dBm. In practice, any measurement above -50dBm can be considered a good, strong signal, and should get you close to the full performance your hardware is capable of.

Weaker signals are still usable, but are more susceptible to transmission errors, leading to slower, uneven data transfer. VoIP vendors typically recommend a minimum signal strength of -67dBm for reliable real-time voice communications; at -80dBm you might see intermittent glitches, and at -90dBm a regular Wi-Fi device probably won't be able to connect to the network at all. This is thus effectively the bottom of the scale, although scientific radiometric equipment can detect much weaker transmissions.

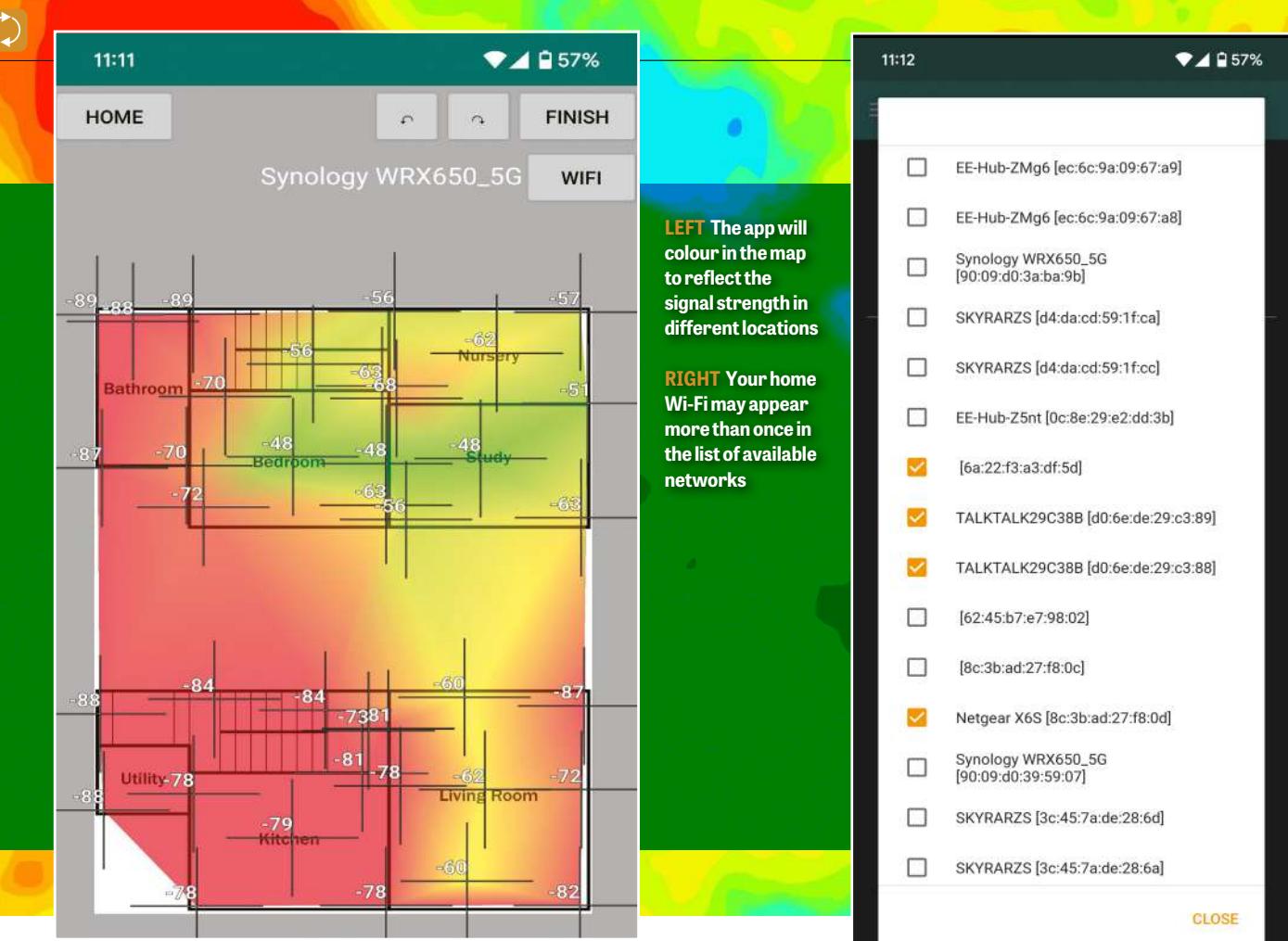
If you're thinking that a negative logarithmic scale that runs from -90 to -30 is a little counterintuitive, you're not alone. This is why Windows converts the raw signal strength into a percentage. If you want to see raw dBm figures on a Windows machine you'll need to use a third-party tool; remember that measurements taken on your laptop might not be directly comparable to those you get from a smartphone, owing to different antenna sizes and designs, but the overall coverage pattern should be very similar.

again published by Webprovider and available from Google Play. It's a little old and clunky, but it's free and does everything we need. If you're using a different app, the process of making your heatmap will naturally differ, but the overall principles will be the same.

Before you start using Heat Map, you'll need to create a floorplan of your home or office. If you like, you can draw one on paper: the app can import a photo directly from your phone's camera, so you can simply snap it at the appropriate time. If there are multiple storeys to your building, you may draw them next to one another, or create an individual map for each one.

Alternatively, you can make a digital floorplan. Heat Map can import images in popular file formats such as PNG and JPEG, so you can use almost any tool you like for this, from Paint to AutoCAD. If you're seriously interested in creating an accurate map of your home, you could even turn to a specialist tool such as Floorplanner, which is free for personal use (see floorplanner.com/personal).

Once you've created your image file then you'll need to move it onto



your phone's local storage so that Heat Map can access it. You might do this by emailing it to yourself and then downloading it, or using a cloud service such as Google Drive. You're now ready to run the Heat Map app.

CREATE YOUR SURVEY

When you first open the Heat Map app it asks for permission to access your location; naturally you'll need to grant this to make the app useful. You'll then arrive at the Home page of the app, which shows a single button inviting you to "Create new session". Tap this, then wait a few seconds while the app scans for visible networks.

The Session settings page will now open. Tap the button labelled "Select Wi-Fi channel to track"; this label is slightly misleading, as the app now brings up a list of visible Wi-Fi networks (rather than radio channels).

There's a good chance that your home Wi-Fi will appear more than once in this list – for example, this will happen if your router is using the same name for the 2.4GHz and 5GHz bands, as these are really different networks. Tick every transmitter that you want to map, including any additional access points, extenders or mesh stations. The app doesn't currently support 6GHz networks, but you can expect Wi-Fi 6E coverage

to be similar to regular Wi-Fi 6. Once you've selected all your networks, hit Close at the bottom of the page to return to the Session settings page.

Now tap the line labelled "Session title"; if you're planning to create multiple maps then it will be helpful to provide a distinctive description. Next, tap "Pick a background" and either take a photo of your floorplan or import your file from local storage. Finally, hit Start to enter mapping mode.

FILL IN THE MAP

The map mode opens with a view of your floorplan, scaled to fit your device screen. You can pinch to zoom in and out, and use two-finger scrolling to pan around the map. If you need to rotate the image, you can use the orientation icons at the top of the screen.

Now comes the fun part. Go and stand somewhere in your house, then press a finger onto the corresponding location on your digital map. A crosshair will instantly appear. If you've slightly fumbled the position, you can now drag this crosshair to the right place. Hold your finger still for a second and a message will pop up saying "Scanning – please hold your position".

A moment later, the crosshair will be marked on your map, along with a number representing your Wi-Fi signal strength. If you've made a

mistake with the location you can tap the crosshair, then tap "Remove point" at the bottom of the screen to delete it. Once you're happy with your measurement, go and stand somewhere else and repeat the exercise. As you capture additional readings, the app will start to colour in the map to reflect how the signal strength changes between measurement points.

It only takes a few minutes to build up an overview of how your wireless signal propagates around your home. Be warned, though, that Heat Map always applies an even colour gradient between measurement points, which may not reflect your reality; to get a clear picture of how things like walls and ceilings affect signal strength, we recommend taking a reading from the centre of every room, plus every corner. Especially so if you're mapping multiple floors of a building on a single image, as the software will apply colouring as if the storeys are all situated next to one another.

If you've selected multiple Wi-Fi transmitters, the software is smart enough to measure them all at once, so you only need to make one circuit of your home. Although the map only shows signal strength readings and colours for one network at once, you can switch views by tapping the "Wi-Fi" button at the top right

SIGNAL STRENGTH ≠ PERFORMANCE

A strong wireless signal isn't always a guarantee of fast performance. If your heatmap shows that a computer is sitting pretty in a bright green area but it's still getting sluggish network speeds, here are some possible causes to investigate.

OLD WI-FI STANDARD

Wi-Fi devices from different eras are gloriously interoperable – you can connect a Wi-Fi 5 client to a Wi-Fi 7 router, or vice versa, without having to worry about the differing technologies. However, this means you could be running an outdated connection without realising it. If a device is being slowed down by an older Wi-Fi standard, you may be able to give it a boost by changing its settings or fitting a new network card.

SLOW RADIO BAND

Wi-Fi works across three separate radio bands – 2.4GHz, 5GHz and 6GHz. The 2.4GHz band has the slowest data rates, with many routers capping it at around 600Mbps/sec, while 5GHz

and 6GHz connections can go up to 4.8Gbps/sec. The 2.4GHz band can provide longer-range coverage, but in most cases you can boost a device's performance by moving it onto a different band.

POOR SIGNAL-TO-NOISE RATIO

Many domestic networks are affected by radio interference from other nearby networks or electrical appliances. This can cause even a strong Wi-Fi signal to suffer data errors, resulting in slow performance. Switching to a different radio frequency can help; some routers automatically select channels to avoid interference, but if yours doesn't you can try changing your router setting manually. As long as the network name stays the same, client devices will follow.

NETWORK CONGESTION

A final possible cause of performance issues is an overloaded network. If too many devices are trying to exchange information at once, the router may simply not have the wireless bandwidth to give them all good service. In a case like this, optimising your signal strength won't help; try moving some devices onto a different network band or switching them to wired connections – or buy a more powerful router.

IF YOUR ROUTER ISN'T IN THE RIGHT PLACE, A HEATMAP WILL TELL YOU LOUD AND CLEAR

of the screen and selecting which transmitter's map you want to see.

We have just one caveat to using the Heat Map app: in our experience it sometimes gets stuck recording the same signal reading in every location. If this happens, you can clear the error by tapping the Finish button twice (this toggles the app out of Edit mode, and then back into it again). You can now carry on with your measurements; any erroneous data points can be deleted by tapping on them and selecting "Remove point".

When you've finished capturing readings it's time to hit the Finish button in earnest. A button now appears in the bottom corner labelled Export. From here you can export your heatmap as a PNG image, or as a CSV file detailing all the measurements captured and their X and Y map coordinates. If you have multiple transmitters, use the "Wi-Fi" button to switch views and export their data one after another.

READING THE MAP

Now you've got your lovely colourful heatmap you might be thinking – so what? I already know from bitter

experience that the Wi-Fi signal is no good in the upstairs bedroom.

But the information provided by a heatmap is more detailed than this. It reveals how the structure and layout of your home affect Wi-Fi transmission, enabling you to make smart decisions about where to locate your computers and devices.

It can also help with network performance issues, giving you clues as to whether a slow connection is due to a weak signal or a client configuration issue – see "Signal strength ≠ performance", above. You can use your heatmap as a baseline reference for optimising the overall performance of your home network. Tweak your wireless settings to your heart's content, or even try out a few different routers; your map lets you quickly determine whether your changes have helped things or made them worse.

Finally, if your router isn't in the right place, a heatmap will tell you loud and clear: when the green areas are all bunched up in one corner of the house, and the rest is a sluggish amber, you know what you need to do. If it's not practical to move the

router, you can use the heatmap to identify the best place to install an extender, and generate a new map to measure how effectively it's reaching previously underserved parts of your home.

The same principle applies to any mesh systems that might want redistributing. Remember, a client device will normally lock onto whichever mesh node it's seeing the strongest signal from, regardless of how many hops away from the main router unit this may be. You can often improve performance by moving your satellite units further away from the hub, so they're not "distracting" devices that could connect directly to the primary station. Those clients will then get a faster, more direct connection to the network, and there will be less traffic travelling back and forth between stations – so in systems that don't have a dedicated backhaul channel, there's more bandwidth available for your use.

Creating a heatmap may seem like a quaintly low-tech pursuit. Not many networking projects involve breaking out the sketch pad, and then going for a stroll around your home. However, generating your map costs nothing more than ten minutes of your time, and it's a powerful resource for getting the best coverage – and hence, hopefully, the best performance – from any wireless network setup. ■



LinkedIn

MAKE IT WORK FOR YOU



There's more to the professional networking site than you may realise. **Nik Rawlinson** explores the features that can help you advance your career

An old adage says you should dress for the job you want, not the job you have. Today's equivalent might be to dress up your online profile – and that applies particularly on LinkedIn. While there are occasional career opportunities to be found on social sites such as Facebook and X, the Microsoft-owned professional networking platform remains one of the best and most appropriate forums for shopping your skills to potential employers.

As with every online service, though, getting the best from it means understanding how to take advantage of its key features. Let's take a look at how you can stand out, improve your discoverability and build connections on LinkedIn. This should strengthen any applications you make on the site, and increase the likelihood of an active approach from potential employers who browse your page.

Get started today

LinkedIn is best approached proactively. If you leave your profile blank until you see a promising opening, you risk missing out on unadvertised opportunities. Think of yourself as a product, and LinkedIn as a storefront: you can increase the likelihood of a passing employer making an impulse purchase – or job offer – by ensuring that your skills are kept regularly up to date, responding to posts and seeing if there's anything you can contribute off your own bat.

As long as it won't risk your current position, you should also make it clear that you're open to opportunities. To do this, visit your LinkedIn profile and click "Open to" at the top of the page, then choose "Finding a new job". You can now select the kind of position you're after by specifying location (including hybrid and remote), whether you're actively applying or just casually looking, the

working conditions you'll consider (full time, contract, temporary and so on) and whether your availability for work should be visible only to recruiters or to all LinkedIn members.

That last decision might involve a bit of thought. Restricting this part of your profile to recruiters might stop your current boss from finding out that you're looking for opportunities, but it's still a semi-public statement. Then again, it can be beneficial for your current employer to know that you're considering your next move – it may prompt them to offer you incentives to stay.

Even if you're not keen to move, LinkedIn can be helpful when it comes to negotiating a raise. Click the "Jobs" tab at the top of the homepage and browse for roles similar to your own, either local to yourself or with the option of remote working. Make a note of the responsibilities involved and pay on offer; this will help you to gauge whether you're currently being fairly paid. And if not, it will provide evidence you can use to persuasively petition for a salary uplift.

Perfect your profile

Many people use LinkedIn primarily as an online CV service, and it does

this job perfectly well. To help your profile stand out from the crowd, though, go beyond the basics when outlining your career to date. Don't just list job titles, but talk about outcomes and improvements you have made in your current and past roles, as well as the responsibilities you've taken on. Remember that you only have one profile that's visible to everyone – you can't tailor it for different industries or roles, so emphasise your core transferable skills, rather than making it too niche or technical.

As well as singing your own praises, LinkedIn gives you the powerful ability to curate your own references. Don't be shy to ask past and present colleagues and employers for a recommendation. Encourage them to be as specific as possible. "What most recruiters look for on LinkedIn are unique and detailed recommendations," said Sophie Deering at theundercoverrecruiter.com. "For example, recommendations that talk about a job candidate's strengths, how the job candidate got along with other co-workers, how the job candidate overcame problems at work, etc. Recommendations with examples are even better. For example, 'John boosted sales by 47% in one year' is much more powerful than 'John increased sales'."

Definite articles

As well as sharing your education and employment history, LinkedIn allows you to create posts just as you would on any social media site. These might be short-form updates, perhaps with photos, or longer pieces called articles. The latter are a powerful tool for selling your services, as they let you directly demonstrate what you can bring to an organisation.

It's worth thinking carefully about the kind of article you can post that might encourage an employer to click through and learn more about you. LinkedIn itself suggests that the most successful articles are ones that start conversations ([see tinyurl.com/355publishing](http://tinyurl.com/355publishing)).

Examples include workplace issues, professional insights, concise recaps, and future-of-work insights.

Plan out what you're going to say before putting fingers to keyboard, as a slapdash piece could harm your chances of landing your dream position. It's also worth going back through your posts and articles periodically to make sure that content you've previously posted isn't horribly out of line with current realities.

If writing isn't your forte, you might be tempted to lean on AI tools to help generate your content.

Tell us what kind of work you're open to

* Indicates required

Job titles*

Writer

+ Add title

Location types*

On-site Hybrid Remote

Locations (on-site)*

Chelmsford, England, United Kingdom

+ Add location

Start date

Immediately, I am actively applying
 Flexible, I am casually looking

Employment types

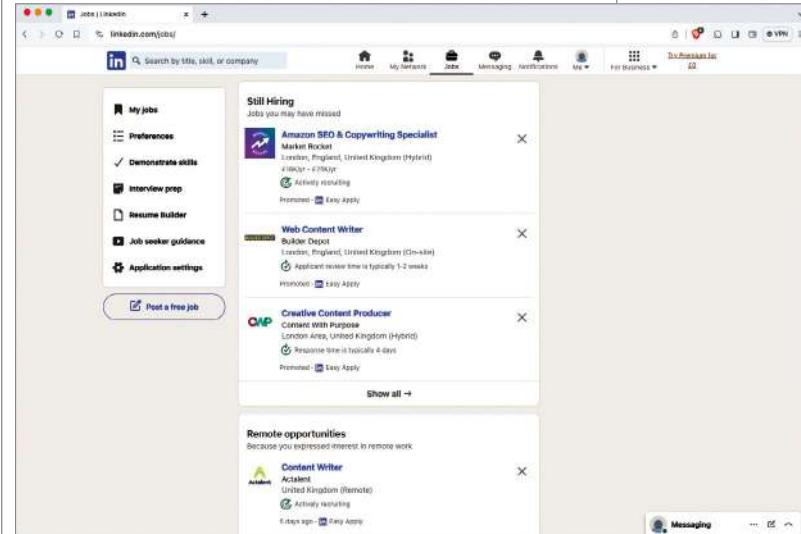
Full-time Part-time Contract
Internship Temporary

Visibility (who can view you're open to work)*

Recruiters only
Limited to people using LinkedIn Recruiter
While we take steps not to show recruiters at your current company, we can't guarantee complete privacy.

All LinkedIn members
Includes recruiters and people at your current company
This selection adds the #OpenToWork photo frame.

[Learn more about your privacy](#)



Be careful with this, however: LinkedIn itself won't penalise computer-assisted posts, but if you disclose your use of AI, potential employers will be left wondering to what extent the insights you're posting are really your own. Conversely, if you're not up front about the provenance of your text, you could find yourself in a pickle when an employer discovers that you're not really as insightful or fluent as your articles suggest.

TOP Make sure potential employers know that you're open to offers

ABOVE LinkedIn's listings can help you gauge if you're being fairly paid

If you leave your profile blank until you see a promising opening, you risk missing out on unadvertised opportunities

Improve your visibility

Once you've bolstered your profile, you'll want to make sure other users can find it. If you've previously only used your LinkedIn account to browse jobs and other people's posts, you're doing nothing to promote your own skills or help potential employers get in touch. To fix that, click "Me" on the top bar, followed by "Settings & Privacy", then click "Visibility" in the sidebar to access the settings that help you make your presence on the platform felt.

For a start, when building your network it helps to let others know when you've viewed their profile; this encourages them to visit yours in return. Click "Profile viewing" and make sure "Your name and headline" is selected. If you're happy to be



This is a post I really hoped I wouldn't need to write, but it's something that needs addressing -- sooner, rather than later.

Those of us who have worked in a British school over the last five or six years can't fail to have noticed the way that

• Draft - saved

contacted directly, rather than just through LinkedIn, make your email address public by clicking "Email visibility" from the Visibility page, and selecting "Anyone on LinkedIn". Other options allow you to restrict this information to first-degree, or first- and second-degree connections, or keep it private.

A related option is "Profile discovery using email address"; this helps people who have encountered you outside of LinkedIn to find your profile. Likewise, you can allow your

phone number as another variable on which potential employers can search. There's a slightly curious inconsistency in the terminology used here: to make yourself fully findable, you'll want to set "Profile discovery using email address" to "Anyone", while "Profile discovery using phone number" should be set to "Everyone".

Finally, make sure that LinkedIn publicises any changes you make to your profile, such as new job titles or qualifications. To enable this option, click "Share profile edits with your network" and make sure the switch on the next screen is set to On.

If you're worried that these settings will expose you to LinkedIn members you'd rather not interact with – such as former employers with whom you've had a difficult relationship – you can proactively block individuals from seeing your

ABOVE Got something to say? Try writing an article to spark a conversation

BETWEEN Let LinkedIn promote you by setting it to share profile edits

information. To do this, visit their profile and click "More" beneath their summary, followed by "Report/Block".

Contribute to the community

LinkedIn is all about building a network, but be aware that the platform offers two subtly different types of relationship. When you and another member connect, you can communicate freely and will see each other's activity. When you follow someone you'll see what they post, but they won't see your content unless they follow you back.

Not all potential employers will want to connect with you, especially if you've not had any previous interaction. Pre-empting them by asking to connect when they don't know who you are could be seen as pushy. If you want to get to know a potential employer, it's safer to start by following them. To do this, visit their profile and click the "+ Follow" button immediately beneath their summary.

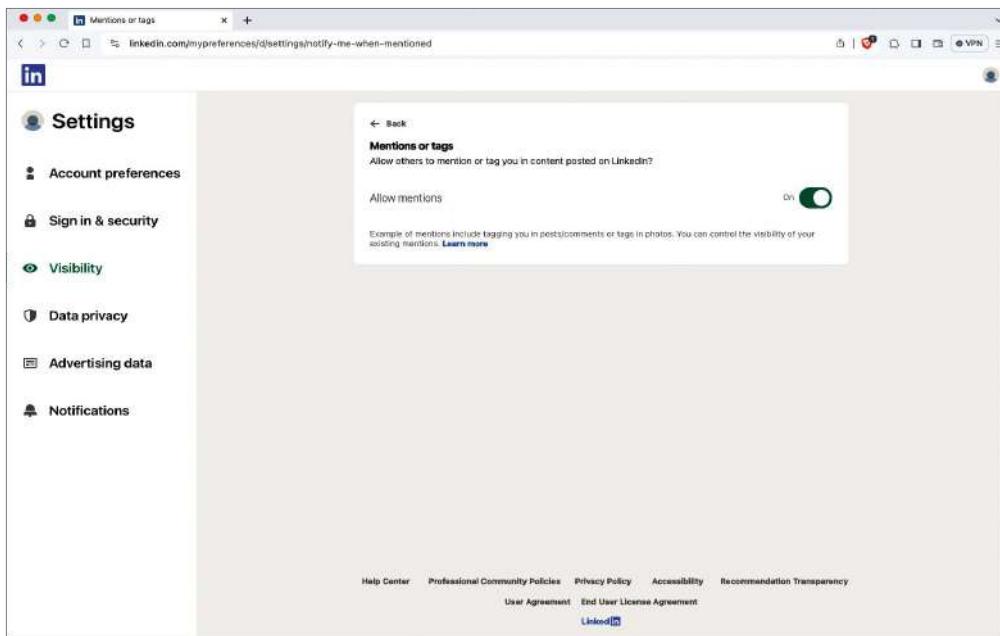
Don't think that just passively following is enough, however. Take the time to regularly catch up with their content. Apart from anything else, you'll pick up insights that might come in handy in an interview – with that employer, or another. Where appropriate, you can attract their attention by adding a response to what they've posted. Resist the temptation to jump in too eagerly, though: you want to be seen as a valuable contributor, rather than just a source of noise.

Bear in mind, too, that when senior businesspeople post content they won't necessarily have written it themselves – that's what copywriters and marketing departments are for. Don't assume therefore that they'll

Sharing profile edits
Should we notify your network of key profile changes (such as new job, education, certificate, profile video) and work anniversaries?

Share key profile updates

Help Center Professional Community Policies Privacy Policy Accessibility Recommendation Transparency
User Agreement End User License Agreement LinkedIn



want to engage with you in a deep technical conversation about the specifics of a post. Just consider the interaction as an opportunity to put yourself respectfully and productively on their radar, and on the radar of any others following the same content.

A bolder way to draw attention to yourself is to make a post of your own in response to a piece of shared content, and tag the original author. This may encourage them to share your piece or send you a message – but if they don't respond, resist the temptation to pester. They may be too busy to respond, and may even have turned off mention notifications. If you want to turn these off yourself, go back to the "Visibility" settings page mentioned above; under "Visibility of your LinkedIn activity", click "Mentions or Tags", then set the switch to off.

If you don't have anything original to add to other people's posts, you can alternatively provide value by acting as a curator, sharing useful and thought-provoking links from across the network, perhaps with short summary posts of your own. Establishing yourself as a trusted source of valuable information demonstrates your understanding and commitment to your industry.

At the same time, don't be afraid to post content that's tangential to your professional goals. An analysis of 3,000 LinkedIn posts from 150+ enterprise CEOs carried out by **trends.ceu** found that only 20% of posted content was aimed directly at customers or industry. The rest included company news, leadership and mentoring and employer branding. If it's good enough for them, it's good enough for you, too.

Get creative

Once you've attracted more than 150 followers or connections, you can enable LinkedIn's Creator mode. This gives you additional tools for publishing newsletters through the platform, and automating submissions for LinkedIn Live and Audio Events. The former lets you broadcast video content through your profile, while an Audio Event enables you to stream live audio, similar to a podcast or radio broadcast, with which followers can interact.

Video and audio content is great for raising your profile: it's "sticky" stuff that encourages visitors to engage with you for longer periods, and to come back regularly. If you don't see yourself as a broadcaster, consider the newsletter option instead as a way to promote your expertise or curation, in a way that lets you reach even infrequent visitors. A LinkedIn training post from the start of this year noted that: "When you create a LinkedIn post, it has a feed lifespan of about 24 hours. However, only 16.2% of LinkedIn users are active daily, [so] after about 24-48 hours, your hard work ends up in your activity section on your profile for people to dig through like a content graveyard. [However, if you post it] as a newsletter, it can now be delivered directly into your subscriber's inbox. No, not their LinkedIn inbox, their Gmail or Outlook or whatever service they use inbox."

In other words, if you can attract the attention of a potential employer just once and persuade them to subscribe to your newsletter, you then have a direct channel of contact with them, even if they only rarely log into LinkedIn itself.

ABOVE If you're being mentioned a lot, you can suppress related notifications

Once you've attracted more than 150 followers or connections, you can enable LinkedIn's Creator mode

LinkedIn Premium

You can do an awful lot with LinkedIn for free, but the paid LinkedIn Premium service takes things further. LinkedIn is currently promoting Premium's AI features; as we've noted, these should be used with caution, but the tools on hand promise to help enhance your headline, summary and experiences, write personalised message drafts to recruiters, and deliver "personalised AI-powered advice and takeaways" on topics that matter most in your feed and advice on the right jobs for you.

Other benefits include the ability to find jobs where you'd be a top applicant (which should save time when looking for a new position), an option to tell managers that their job is your top choice, and the ability to use InMail to connect with anyone on LinkedIn, even if they're outside your network. LinkedIn claims that this approach is 4.6 times more effective than email alone.

There are five different Premium subscriptions, and it's worth checking which features each tier includes before signing up. Premium Career, for example, costs £40 a month but includes only five InMail credits per month, so you'll have to use them wisely.

You can find out more about the different tiers by completing the quiz at linkedin.com/premium, which will help you select the most appropriate option for your needs. ■

Reviews



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Apple Vision Pro

Expensive and far from perfect, but it's amazingly immersive and rethinks both mobile computing and entertainment

**PC
PRO**
RECOMMENDED

SCORE ★★★★☆

PRICE From \$3,499 from apple.com
(US only for now)

“What the heck is happening?” That’s what I said to myself as I played virtual DJ, spinning two records in front of me with a cross-fade knob and special effects I could control with my hands in mid-air. I just reached out and touched them.

I had a similar what-the-heck moment – in a good way – when I just looked at my MacBook to connect and supersize its display on the wall in front of me. Then I pinned the Apple Music app to the left of my desk and Slack to the right. This is what Apple means by spatial computing.

And I was left almost speechless when I viewed a 3D spatial video of my three dogs coming towards the camera. It’s so immersive you may get a bit emotional. Oh, and you can watch regular 3D movies in Apple TV+ that blow away your local cinema.

In short, the Apple Vision Pro is the most innovative product Apple has created in more than a decade and

a fascinating look at the future of computing and entertainment rolled into one very sleek package. But early bugs and numerous weird things come along with this revolution, including a freaky digital Persona version of yourself that can appear in FaceTime calls.

The real price

Price and availability both count against it, too: for an undisclosed amount of time, it's available only in the USA. The \$3,499 entry-level model comes with 256GB of storage, and it's \$3,699 for 512GB and \$3,899 for 1TB. Wear glasses? There's no room for them in this sleek headset. If you use reading glasses, the Zeiss optical inserts “for readers” cost \$99, while prescription lenses cost a surprisingly reasonable \$149; I also like how easily they magnetically attach to the Vision Pro.

RIGHT Other people see a digital version of your eyes when you're wearing the headset

ABOVE The Vision Pro is a revolutionary product, but you'll pay for the privilege

That's where the good news ends. When you're spending this much on a headset that is so hard to repair – iFixit has given it a provisional 4/10 for repairability (tinyurl.com/355ifixit) due to the fragile components – protection is recommended. In this case, that means spending an additional \$499 for Apple Care+, which gives you two years of unlimited repairs.

Apple is offering numerous accessories, too, including Belkin's battery holder for \$49. However, the one I recommend most is the \$199 travel case, which is bulky but will protect the Vision Pro when you're flying or just travelling to and from the office.

The total cost of this device if you opt for the 256GB model, need prescription lenses, add Apple Care+ and want the travel case? That's a tidy \$4,346, plus sales tax, plus – assuming you bring it back to the UK and declare it – an import duty totalling in excess of £500.



■ Top dollar, top quality

At least you get a big box for all the investment, and there's lots of stuff in it. This includes the personalised Light Seal (your face is scanned during the ordering process), the Light Seal Cushion and both the Solo Knit Band and Dual Loop Band. There's also the Apple Vision Pro battery, which remains tethered to the headset at all times, a second thicker Light Seal Cushion, a polishing cloth and a 30W USB-C power adapter.

But it's the Apple Vision Pro that matters, and this is easily the sleekest headset yet. However, don't equate sleek with light: after 30 minutes I felt it weighing on my cheeks. At around 600g (the exact amount depends on the Light Seal and head band configuration), it's like wearing an 11in iPad Pro on your head. For added context, the Meta Quest 3 (see issue 351, p56) weighs a shade over 500g.

The Solo Knit Band is stretchy, making it easy to take the Vision Pro on and off, and you can quickly tighten and loosen the fit with the built-in knob. However, the Dual Loop Band provides more stability because its strap goes across the top of your head and the back. Thankfully, it's easy to swap these out due to the Vision Pro's modular design. The Light Seal (which is matched to your face to block all stray light) and Light Seal Cushion attach magnetically to the device, and swapping out the two band options involves first pulling on little orange tags. The magnetic connection could be stronger, though, as the Light Seal detached a couple of times when I was picking up the headset. You're better off holding it by the metal and glass frame.

I found the Dual Loop Band better for longer Vision Pro sessions as there's more support for what is a pretty weighty headset. I wore it on and off for several hours without discomfort – although I took periodic breaks due to the sheer heft of the unit – and noticed light red marks on my cheeks at the end.

■ Use case

One reason you'll stick at it is that the Apple Vision Pro is so easy to operate. There are no controllers to deal with. You just use your eyes to look at the element you want to select and then tap your thumb and index finger together to "click".

While setting up the Vision Pro, I was immediately accustomed to the input because you're walked through a calibration process that involves following a dot around the screen and selecting it. Then you're greeted with a homescreen of iOS-like icons that float in front of your view of the room you're in.



VisionOS starts with your real-world view as the baseline, because the Vision Pro wants to bring digital content to your environment instead of taking it over. And the video passthrough is very lifelike (much better than the Quest 3, despite what Mark Zuckerberg may say), as the dedicated R1 chip is fast enough to stream images to the Vision Pro's micro-OLED displays within 12 milliseconds – that's 8x faster than you blink. I had no problem walking around my house with the headset on.

As you stare around the homescreen view and move your eyes from icon to icon, they light up ready to be selected. This is immensely satisfying, relaxing and easy to do, because the Vision Pro has downward-facing cameras that track your hands in your lap.

The eye tracking is so good it's also used to authenticate you via Optic ID, which measures your pupils for security. Think Face ID for your eyes. It works well, but a couple of times during my testing it failed, at which point I needed to enter my PIN code via a floating keypad; an annoying process.

Gestures work perfectly. Scroll from left to right and up to down by pinching your fingers together and dragging towards the direction you want to move. Zooming in on a photo or web page is as easy as pinching your fingers together with both hands and spreading them apart. It's *Minority Report*-cool.

I also tried the Vision Pro in complete darkness, at which point I received a warning that I wouldn't see my hands. But the

ABOVE The battery is your constant and weighty companion

hand- and eye-tracking interface still works, so you can definitely watch films in bed.

"I was left almost speechless when I viewed a video of my three dogs coming towards the camera. It's so immersive you may get a bit emotional"

So what can you do with the Vision Pro? For starters, it's a multitasking champ, thanks to the built-in M2 chip that runs the OS. For example, I launched Safari in the centre of my space, then I turned to my left, asked Siri to launch Photos and the app

appeared. Next, I turned to the right of Safari and opened Apple Music so I could have that playing in the background.

Even better, it's easy to move apps around in your virtual space by

selecting the bar beneath the app, and you can resize them by staring at the bottom right corner and dragging it with your finger. If you want to close an app, you can either stare at the X beneath the window or simply ask Siri to close all apps. You can also instantly go back home by long-pressing the digital crown on the right side of the headset.

At any time you can pull up the Control Center by simply looking up and clicking on the floating downward-facing arrow. From this menu you can change Environments, turn on Guest mode, access Wi-Fi and Bluetooth, start screen recording and more.

One of the options in Control Center is the ability to connect with your Mac, but you can also bring your Mac desktop into the Vision Pro just by looking at it. I saw a Connect button

BELLOW Pressing the crown on the top takes you to the homescreen





floating above my MacBook, pinched my fingers together, and my laptop's screen went blank, popping up on the wall in front of me instead.

You don't get multiple desktop views, but you do get a 4K display that renders text crisply, and you can make that canvas positively huge so it dwarfs a typical monitor. Your keyboard and mouse still work as they normally would with no latency. You can even use your keyboard in Vision Pro apps if you want. And you may well do, as the floating keyboard isn't very satisfying. For one, there's no tactile feedback, even though you hear clicks as you type, and you can't type quickly; it's a peck-peck-peck scenario with one or two hands.

I do like that you can enter text with your voice, however. For example, if you're in Safari and you just stare at the microphone icon in the address bar and speak an address then it will automatically take you to that website.

Environments and entertainment

One of the unique aspects of the Apple Vision Pro is your choice of multiple Environments. Think of them as 3D desktops on steroids. There are several options available, ranging from Yosemite and Haleakala to the Moon.

I pulled up Mount Hood and was floored by the level of realism, with detailed sand and rocks beneath my feet, rippling water in front of me and a towering mountain in the background. And you get to decide how immersive the Environment is by turning the digital crown clockwise (more) or anticlockwise (less).

Some Environments are unique to specific apps. For instance, Apple TV+ has its own cinema Environment

for watching films that makes it feel like you're watching a 30-metre screen, while Disney+ lets you use the Avengers Tower as your backdrop – complete with a collection of Iron Man suits – before playing a show or movie.

And this device will make even the biggest sceptic a believer in 3D movies. There are hundreds available in Apple TV+, and I couldn't believe how good *Man of Steel* looked through the Vision Pro. As *Superman* took off for the first time, it was like he flew right over my shoulder. The more recent *Super Mario Bros* film was even more immersive, with the characters popping off the screen as Mario flew around in his raccoon suit while being chased by an oversized bomb.

This is a good time to mention that the sound from the Apple Vision Pro is surprisingly potent. There are two audio pods built into the strap positioned close to your ears, and they deliver rich and balanced spatial audio. For example, I could hear Mario coming from the left side of the screen and Princess Peach from the right as they spoke.

When listening to SZA's "Kill Bill" through Apple Music, the audio pods had plenty of punch in the drums and vocals were clear. However, the audio leaks from the Vision Pro when listening, so if you want to keep things private you should wear AirPods. The AirPods Pro 2 with USB-C is your best bet because they support lossless audio.

ABOVE You can choose between the Dual Loop Band above and the Solo Knit Band

"This device will make even the biggest sceptic a believer in 3D movies. There are hundreds available in Apple TV+"

BELOW Build quality is as good as we expect from a premium Apple product

To videos and beyond

If you want to take entertainment to the next level, there's Immersive Video, a new format that delivers a 3D experience via 8K recordings with a 180° field of view. I almost lost my breath when I watched a highliner attempt to essentially walk a tightrope between two mountains 3,000 feet above the ground in Norway.

As she narrated her thought process, I was mesmerised by the surrounding landscape, veins popping out of her feet as she walked barefoot across the chasm and the intensity in her blue eyes. In another Immersive Video starring Alicia Keys, I felt like I was in the studio with her as she rehearsed, and I could see her backup singers as I peered over to the right and the instruments and speakers on the left.

Apple has shown other examples of how Immersive Video could come to life, such as through a goalkeeper's perspective during a football match. This idea isn't new, but with Apple's backing it could become a game-changing format for watching sporting events.

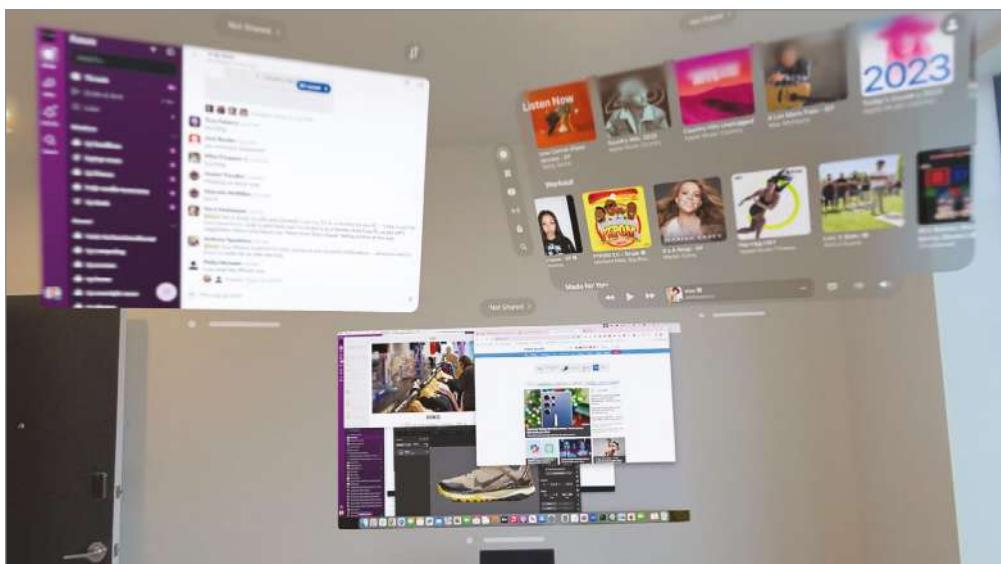
Another big selling point is spatial photos and videos. You can take 3D stills and videos using the headset itself or capture spatial videos (but not

photos) with the iPhone 15 Pro and iPhone 15 Pro Max. I took a spatial video of my three dogs and each pup looked incredibly lifelike as they ran closer to the camera. You'll get the best results if your subjects are moving and you stay fairly still, as I lost the immersive effect when I turned my head to follow them around. To take a spatial video with the Vision Pro, you use the top button on the left side of the headset, but I guarantee you'll be made fun of by family and friends.

The Vision Pro also brings panoramic photos to life in a new way by wrapping them around you. It's as if you're standing in the centre of the frame. For example, I took a panorama of the Manhattan skyline from the balcony of a Bronx apartment building, and I was completely immersed in the photo, from the Coca-Cola truck on the left side of the frame to the bridge in the centre and the tall skyscrapers peaking through the cloudy background.

Even regular photos take on new life in the Vision Pro





LEFT As you move your eyes from icon to icon, they light up ready to be selected



as you scroll through your gallery. I had a blast reliving pics I took on a trip with my son to see Niagara Falls and a Buffalo Bills game.

■ Apps and games

The Apple Vision Pro can run more than a million compatible iPhone and iPad apps at launch – they appear as a 2D experience on a screen – but I was more interested in testing the native Vision Pro apps. While the selection is modest for now, with a little over 600 native Vision Pro apps so far, some of the experiences are mind-blowing. Other Vision Pro apps seem more like tech demos than full-blown apps.

The most impressive Vision Pro app I tried is djay, which puts you in front of a mixer and turntables. I had no idea what I was doing but was still blown away by the realism of the deck and the fact that I could interact with all the buttons, sliders and needles as if they were there. And there are wild transparent boxes that you can put your hand through to make special effects. This is nuts.

SkyGuide puts you inside a planetarium wherever you are. As you look up at the night sky

you can make out constellations and use a laser pointer to draw in the sky. This is an app that made my teenage son go “woah,” so you know it’s good.

Other notable Vision Pro apps I tried include JigSpace, which lets you place 3D animations and models right in front of you, from an aeroplane engine to a Formula One racing car, complete with realistic light reflections. And Voyager by ForeFlight makes you feel like an air traffic controller as you watch real-time 3D visuals of planes taking off and landing at various airports.

While it’s a short experience, the Encounter Dinosaurs app from Apple is a heart-stopping example of what’s

ABOVE The djay app is incredibly realistic – and great fun

“The most impressive Vision Pro app I tried is djay. I had no idea what I was doing but was still blown away by the realism”

BELLOW The floating keyboard is one of the few weak points



possible with the Vision Pro. A butterfly lands on top of your finger before a giant dinosaur enters the frame, sees that you’re looking at it and then jumps out of the screen so that his nose is inches from your face. It’s scary and thrilling.

I should also note the apps that aren’t yet available, such as Netflix and YouTube. There aren’t even iPad-compatible apps. When asked about snubbing the Vision Pro, Netflix’s CEO said that they’re in discussions with Apple but right now the device is “so subscale that it’s not particularly relevant”.

I didn’t find a “killer” game, but Synthriders, which is also available on Meta Quest, is a fantastic example of mixed reality done right. You use your hands to touch colourful floating balls and beams of light coming at you to the beat of a song, and you can also dodge and duck obstacles.

Next I played What the Golf?, a casual mini golf game where you can place the virtual course anywhere in the room and start putting. To hit the ball you put your fingers around it and pull back; you’ll see an arrow that you can then direct with your hand. Let it go and the ball heads towards the pin. Trying to select the ball didn’t always work first time, but I loved that I could walk around the course to get a different vantage point and the view never stuttered.

In addition, I tried a few iPad games with a connected controller on the Vision Pro, such as SonicDreamTeam. The action and graphics were smooth,

but it’s essentially a 2D experience on a very large screen. You can also play Mac games through the Vision Pro, but I’d like to see more native Vision Pro games that take advantage of

your hands, such as fighting games and first-person shooters. For example, the Meta Quest 3 has a great sword-fighting game called Broken Edge. Gaming is one area where Apple needs to catch up.

■ Persona and presence

Apple doesn’t want people to be closed off from the rest of the world while using the Vision Pro, so it has developed a few technologies to keep you connected. The first innovation is EyeSight, which allows others to see a digital version of your eyes when they try to engage you while you’re wearing Vision Pro. So while you’re watching content and they walk into the room they might see a shimmer of light on the front display, but as they

get closer and start to chat with you you'll see the person break through into your view and they'll see your eyes. It's a subtle effect and a bit creepy, but it's effective. Still, there's no substitute for briefly taking off the headset.

The much more controversial feature is Persona, which is in beta and on the surface feels very metaversey and un-Apple. But it started to grow on me (a little) once I started making FaceTime calls. Persona is a 3D avatar of you that you create by scanning your face with the front cameras of the Vision Pro. You'll be guided through the process step by step, which includes holding the headset in front of you, turning your face side to side and up and down, as well as smiling, raising your eyebrows and closing your eyes.

From there, the Vision Pro builds your Persona in less than a minute, and the result is impressive from a technical standpoint but also, well, not quite you. In fact, my wife said my Persona looked like I was put through an ageing filter. The good news is that if you don't like how you look you can always recapture your Persona. You can also tweak it by adjusting the colour tone of your skin and the brightness, and you can choose from multiple portrait-like effects. Contour, for example, is the most flattering.

Once in a video call, you can share your Vision Pro view and any apps you're working in, which is great for collaboration. So Apple deserves kudos for that. And these are early days, with updates to Persona due in visionOS 1.1, so over time you should look more like you.

Speed and battery life

The Apple Vision Pro packs plenty of power between its M2 chip for overall performance and the R1 chip for processing input from the camera, sensors and microphones. It was responsive and fluid whether I was pinning multiple apps in my space, watching 3D movies or playing intense games. The Vision Pro also remained cool to the touch.

However, I did encounter some bugs. For example, during one session the headset refused to open the Photos app I was staring at and clicking on. Taking the headset off and putting it back on fixed the problem. On another occasion Siri refused to open apps such as Slack and Apple Music while opening others. It wasn't a consistent issue, but it was still annoying.

Talking of annoyances, there's the need to keep the



aluminium battery with you at all times. That means in your pocket while standing or resting next to you while sitting. It's 350g, so almost twice the weight of a phone, and while the cord is long enough most of the time, if you're immersed in a game and move suddenly you could tug the battery off a table or sofa onto the floor. Nor am I a fan of how the cord can sometimes get tangled. I had to disconnect the cable a couple of times so it would straighten out.

As for endurance, the Vision Pro's battery is rated for two hours of general use and two-and-a-half hours of video playback. That matches my experience. If you want to use the Vision Pro continuously, you can always plug in the battery using the included USB-C power adapter. And if you can, always keep a fully charged spare, with batteries costing \$199.

Future vision

The Apple Vision Pro is easy to scoff at because of its price, but I would argue that it's the most innovative Apple product since the iPhone. There's an insane amount of ingenuity on display here, from the razor-sharp micro-OLED displays and the super-realistic

ABOVE The headset is designed to keep you connected to the rest of the world

"The Vision Pro is easy to scoff at because of its price, but I would argue that it's the most innovative Apple product since the iPhone"

BELLOW At around 600g, the headset can be tiresome to wear for long periods

video passthrough to the remarkably intuitive and fun interface that tracks your eyes and hands. I'm also very impressed with the spatial computing experience, especially when you add a Mac to the mix.

In terms of entertainment, the 3D video experience on the Vision Pro is unmatched, and Immersive Video in particular has a tonne of potential to change the way we view everything from concerts to sporting events. And

the 3D goodness continues with moving spatial videos and photos that transform your memories into something hyper-real.

App development is clearly still in the early stages, with notable

heavy hitters missing at launch. But many of the AR apps I tried are jaw-droppingly convincing and should hopefully spur more developers to hop on board.

What's not to like about the Vision Pro, other than its price? I found the tethered battery annoying at times and the Personas, while admirable, are unnerving. There's also the fact that these devices are fragile – be careful not to scratch the front unit – while coming with a basic warranty.

The bottom line on the Vision Pro is that it's definitely revolutionary, but it's a revolution very much in progress. **MARK SPOONAUER**

SPECIFICATIONS

- Apple M2 processor
- Apple R1 sensor chip
- 256GB/512GB/1TB storage
- dual 4K micro-OLED screens
- 10x tracking cameras
- 2x main cameras
- TrueDepth camera
- Lidar scanner
- 6x mics
- Spatial Audio speakers
- Wi-Fi 6
- Bluetooth 5.3
- tethered battery
- Apple visionOS
- 600g to 650g
- 1yr RTB warranty





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PCSpecialist Fusion Elite P

This Ryzen 8600G system offers a thin layer of gaming jam today with the promise of much more tomorrow

SCORE ★★★★☆

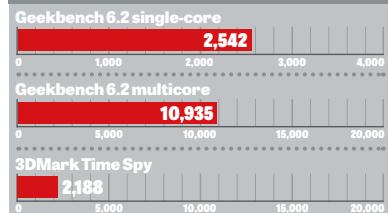
PRICE £541 (£649 inc VAT) from pcspecialist.co.uk/reviews

The AMD Ryzen 8600G was announced at CES 2024, so it's great to see vendors already building systems around the budget-friendly chip. British manufacturer PCSpecialist was the quickest out of the blocks to supply us with a test machine, and if the Fusion Elite P is a sign of things to come then it's fantastic news for people who don't have a bottomless budget. Particularly if they have gaming aspirations, with capable 1080p performance today while a PCI-E x16 slot sits empty for a graphics card when the budget allows.

PCSpecialist chooses an Asus Prime A620M-K microATX motherboard as this PC's foundation. It isn't the most expandable of boards, with two SODIMM sockets and one M.2 slot. They're all occupied, with high-quality 8GB Corsair Vengeance DDR5-5200 DIMMs and a PCS-branded 1TB SSD in place. This is a mid-range SSD, with sequential reads of 3,539MB/sec and writes of 3,131MB/sec.

If you want more storage, four SATA III connectors sit empty at the bottom of the board, and there's plenty of space to house disks: taking off the right-hand panel reveals two 3.5in bays plus one mount for a 2.5in drive. But that's pretty much it for expansion, other than two PCI-E slots: an x1 slot sits empty above the x16 slot for that future graphics card.

BENCHMARKS



ABOVE The Prism case has plenty of space inside to work in



LEFT Liquid cooling powered the Fusion Elite P to some fine benchmark results

You may be tempted to buy sooner rather than later, because the 8600G's graphics aren't exceptional. I started with 3DMark, where it returned a solid 2,188; better than Iris Xe graphics, but behind Intel's latest Arc generation. Games are playable, but you'll likely be choosing Low settings at 1080p.

Here, *Shadow of the Tomb Raider* returned 33fps, *Metro Exodus* 55fps and *Dirt 5* 37fps.

Those speeds are roughly 50% higher than you could expect from a Ryzen 5 5600G.

That chip was based on AMD's Zen 3 architecture whereas the 8600G uses Zen 4, which means a big leap in performance. Liquid cooling helped the Fusion P Elite return a fine set of results in our tests, starting with Geekbench 6.2, where its single-core 2,542 matches the best CPUs around – important here as it means the CPU should keep up with a dedicated graphics card. A multicore result of 10,935 shows the power of a dozen threads, and this was echoed by a 12,885 result in Cinebench R23's multicore test. A PCMark 10 result of 7,129 emphasises this PC's everyday speed.

If you need more power you can always upgrade to one of the latest Rydzens. AMD's popular AM3 platform has finally come to the end of its life, but as the 8600G is an AM4 chip you have an easy route to AMD's current generation of desktop chips, and for the foreseeable future, too.



BELOW The front and rear fans and the cooler all shine with customisable lighting

The Ryzen 8600G will appeal to those who like power efficiency, however, with this system consuming 48W at idle and exactly 100W more when pushed to its full extent. You won't need to upgrade the 650W PSU when you add a graphics card. The chip's efficiency is reflected in this PC's noise levels, with barely a murmur in general use; they go louder when all the cores are pushed into action, but it was never bothersome.

PCSpecialist's Prism case is similarly unobtrusive. The front three fans include RGB lighting, all addressable using Asus' Armoury Crate software, as is the fan at the back. With ARGB lighting on the cooler as well, you can customise exactly what you see through the chassis' tempered glass side.

The downside of this combo of motherboard and case is that there's so much empty space inside. Great to work in, true, but it means you'll need to find space on or beneath your desk for a chunky system that measures 477mm deep and 403mm tall.

Alongside 3.5mm jacks for a mic and headphone, two USB-A 3.2 Gen 1 ports sit at the top. That means they're restricted to 5Gbit/sec, which feels tortuously slow when transferring large files, and it's disappointing that Asus doesn't include any faster USB ports on the rear. It sticks to 3.2 Gen 1 for four USB-A ports, two more are lowly USB 2, and there are no USB-C ports at all. HDMI and VGA ports cover video output, and you

won't be surprised to see a gigabit Ethernet port rather than 2.5GbE. There's no Wi-Fi here.

If these potential bottlenecks don't concern you – that probably boils down to how often you

transfer large amounts of data from disk to disk – then the Fusion Elite P has much to commend it, including a three-year warranty, and the fact PCSpecialist always performs so well in our reader-rated awards for customer service and reliability (see issue 351, p26). And at this price, for a system based on the latest AMD platform, it's hard to argue about value for money. **TIM DANTON**

SPECIFICATIONS

6-core 4.35GHz (5GHz burst) AMD Ryzen 5 8600G processor • Asus Prime A620M-K motherboard • 16GB Corsair Vengeance DDR5-5200 RAM • integrated Radeon 760M graphics • PCS FrostFlow 120 Series ARGB liquid cooler • 1TB PCS M.2 PCI-E Gen4 SSD • PCS Prism TG White ARGB chassis • 650W Corsair RM Series PSU • Windows 11 Home • 217 x 477 x 403mm (WDH) • 3yr warranty (6 months C&R, 1yr RTB parts & labour, 2yr labour only) • power: 48W idle, 148W peak



Philips 49B2U6900CH

This 32:9 monitor might just transform how you work, as it should when Philips is asking so much for it

SCORE ★★★★☆

PRICE £736 (£883 inc VAT)
from uk.insight.com

It's tempting to ignore the diagrams on the Philips 49B2U6900CH box that say, categorically, "this is a two-person job". So tempting, in fact, that I did ignore them, and was soon struggling to attach the gigantic 49in panel to the gratifyingly sturdy metal stand. At least I had the good sense to clear my desk beforehand, as I looked like a weightlifter huffing and puffing it into place.

But it's office workers rather than weightlifters that Philips targets here, particularly those who currently have two or three 27in monitors littering their desk. The idea is to replace such anachronisms with a single screen, allowing you to split your windows across the 5,120 x 1,440 pixels (32:9). Windows Snap does a great job of this, but I found I worked best with my windows scattered around; I could then drag the required window front and centre as required. If your job involves research, you'll love having everything in view.

It's even possible to multitask across two different computers, with a KVM that allows you to switch between sources simply by pressing Ctrl three times. At least one of those sources will need to be connected over

USB-C, and with up to 100W of power delivery (on both upstream USB-C ports) this monitor makes an ideal docking station. It even includes a 1GbE port alongside the four USB-A ports and a USB-C downstream port. Sensibly, Philips places that USB-C port, a 3.5mm jack and two USB-A ports on the left-hand side of the monitor for easy access.

You'll also find a flip-out headphone stand here although, for once, I was pleasantly surprised by the quality of a monitor's integrated speakers; I was happy to listen to music while working on the Philips 49B2U6900CH. Although not bass-heavy tracks, as even this pair of 5W speakers sound hollow.

Philips includes a 5MP webcam, which pops up like a periscope when you need it. It makes sense to keep it up all the time as it can also log you into Windows using facial recognition, plus it includes a "Busylight". So, if it knows you're on a video call, a red strip light runs across the top and side to alert colleagues. Or you can activate this yourself using a button on the bottom left. It's a nice idea, but I hope the next iteration is more prominent.

I also hope that Philips improves the camera. Detail capture is spot on, and the auto-framing option (albeit a tad over-eager) works well, as does the fact that it can accommodate several people in view. However, its colour balance needs work, as everything has a strange, hazy blue quality to it. Hopefully this will be fixed via a software update, but in the meantime I recommend using a webcam and a separate mic, as even at maximum pickup I found the built-in option too weak.



ABOVE The huge 49in VA panel allows you to have multiple windows open at the same time



"It delivers in all key areas. Image quality is strong, it's extremely well suited to office life, and there are useful features galore"

LEFT Connections
include a 1GbE port alongside four USB-A ports and USB-C

I have no such complaints about the panel's image quality. This is a VA panel with a minor curvature, and it's tuned for the sRGB colour space rather than DCI-P3. There's even an sRGB preset, which produces excellent whites. Colour accuracy is fine for its intended office use, with an average Delta E of 1.13. Keeping to the default mode gives you more colours than sRGB mode, covering 79% of the DCI-3 space compared to 68%, and while whites lose some whiteness it's still a great everyday choice.

Brightness goes all the way up to 500cd/m², which is overkill in an office and also consumes more power. At a more sensible 200cd/m² (33% in Philips' brightness setting) it consumed 44W, while pushing it to 100% eats 71W. Philips also offers a bunch of its SmartImage options, including Eco (125cd/m², 37W) and

EasyRead, which are worth exploring.

There's a Movie mode, too, with Philips earning DisplayHDR 400 certification for this monitor. Films look good so long as you ignore the

huge expanse of black to the left and right. It's in driving and FPS games, though, where you truly enjoy the wide expanse, and even though it has a peak 75Hz refresh rate this monitor pays extra dividends after hours.

In fact, it delivers in all key areas. Image quality is strong, it's extremely well suited to office life (note the 150mm of height adjustment), and there are useful features galore. My only real criticism of this monitor is its price. **TIM DANTON**

SPECIFICATIONS

48.9in 5,120 x 1,440 VA panel • up to 75Hz refresh rate • 8-bit + FRC panel (1.07 billion colours) • 4ms response time • DisplayHDR 400 certified • DisplayPort 1.4 • 2x HDMI 2 • 2x USB-C 3.2 Gen 2 (100W power delivery) • 5MP IR webcam • 4-port USB-A 3.2 Gen 2 hub • USB-C 3.2 Gen 2 (15W) downstream • USB-B • 1GbE port • 2x 5W speakers • 60° swivel • -5° to 15° tilt • 150mm height adjustment • 1,193 x 268 x 433-583mm (WDH) • 15.2kg • 2yr warranty

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Lenovo ThinkPad X1 Fold 16

Stunning design, but only business users desperate for a laptop, tablet and desktop in one – with deep pockets – will be tempted



SCORE ★★★★☆

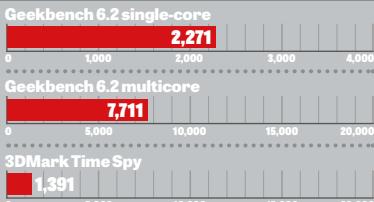
PRICE As reviewed, £3,608 (£4,329 inc VAT) from lenovo.com (before discounts)

Fifteen months. That's how long ago Lenovo announced the ThinkPad X1 Fold 16 Gen 1 – or the X1 Fold Gen 2 as it was then called – at IFA 2022. That was at roughly the same time that Asus' Zenbook 17 Fold (see issue 338, p50) went on sale for £3,300.

Anyone who appreciates fine engineering, however, won't care a jot. Close the bendable 16in screen and it snaps shut like an Audi door, and the hinge is so sturdy that it always stayed locked at my chosen angle.

As the photos here make clear, the X1 Fold 16 doubles as an all-in-one PC courtesy of a separate stand, can be oriented in portrait or landscape, and works as the world's most ridiculous tablet. The only thing it can't do is operate as a standalone monitor.

BENCHMARKS



BATTERY LIFE



Life as a laptop

Let's start with the mode that ThinkPads are most famous for: laptops. Slip the detachable Bluetooth keyboard over the bottom of the X1 and it snaps magnetically into position, turning the X1 Fold into a 12in ultraportable. Albeit one that will strike onlookers as retro chunky, as the base is 16mm thick with the keyboard in place.

As a user, though, you don't notice. Lenovo has miraculously given the keys more travel than most compact laptops, and all the detailing you'd expect of a ThinkPad keyboard is here – from the contoured key tops to the separated cursor keys, from the double-height Return key to the red TrackPoint. It's great to see fingerprint recognition and two backlight levels, too. The only obvious sacrifice is a thin and wide trackpad, but a glass coating keeps things smooth.

You may also find yourself prodding at the touchscreen to aid navigation. There are 2,024 x 1,240 pixels to play with in laptop mode, but viewing two windows side by side is a challenge. Still, I found it ideal when I needed to focus on one task.

I did find myself instinctively closing the laptop with the keyboard in place, but you have to remove the keyboard first. For travel, this connects to the folding stand.

ABOVE The X1 Fold 16 has a premium design, and a premium price to go with it

"Close the 16in screen and it snaps shut like an Audi door, and the hinge is so sturdy that it always stayed locked at my chosen angle"

BELOW The bendable 16in display is bright and accurate



Using magnets, these snap together as a single unit, and attach (weakly) to the outside of the folded tablet.

Life as an all-in-one PC

The stand becomes pivotal once you switch into all-in-one PC mode. Kick out the stand's insert and the tablet slots securely into it (it won't slip). You can either snap the keyboard to the front of the stand or detach it. It's more productive than on a comparable laptop when, say, sitting in a café or hotel room, as you can actually multitask. This is as close to a true desktop PC as you're going to get away from the office.

I also like the fact that it's possible to rotate the screen into a vertical

position, which is particularly useful when you want to see information that flows over several pages. It's a fine choice for image and design work, too.

Life as a tablet

Lenovo describes two more modes for the X1 Fold 16: book mode and portrait mode. In book mode, you view the screen horizontally but bend the panels a little. Like a book, in fact. Lenovo reckons this is great for reading and note-taking.

It mentions the latter because the Precision Pen comes bundled. It's a meaty unit that snaps securely to the top of the frame (when in landscape mode), and with 4,096 pressure levels you can certainly use the X1 Fold as a

graphics tablet. Just don't expect a paper-like feel when you press tip to screen; it's more like plastic on plastic.

As ever with Windows-based tablets, however, the problem isn't the hardware but the software. It's not a totally barren landscape – there's Nebo, OneNote and Scribble Lite for notes, Microsoft Paint 3D and Sketchbook Pro for artists, numerous PDF annotators – but the selection shrinks to nothing next to the variety of iPad apps.

The other problem is size and weight. Unlike an iPad, you can't hold the X1 Fold 16 comfortably in one hand. You'll need to lay it flat on a table, or perhaps support it on the stand (which in effect turns it into an easel).

The power question

Like Asus' Zenbook Fold 17, Lenovo uses a Core i7-1250U processor. This now dates back two generations, but Windows remains sprightly under its command. It's better suited to office tasks than demanding apps, but a multicore result of 7,313 result in Cinebench R23 is very respectable – and over 1,500 more than the Asus, despite that having the same chip. It's a fine result considering the X1 Fold doesn't include any fans.

The X1 Fold stole another victory over its rival in 3DMark Time Spy, with a result of 1,391 versus 1,272, but anyone hoping for a gaming PC will be disappointed. The only way I could force it over 35fps in the undemanding *Shadow of the Tomb Raider* benchmark was by taking the resolution down to Full HD and setting quality settings to lowest.

Battery life is okay rather than brilliant. In our web-surfing test, it lasted only 7hrs 27mins, although switching to laptop mode (where half the screen is active) extended the time by around an hour and a half.

These scores are with the screen set to 150cd/m², but that's still bright enough for easy viewing on AMOLED panels. It's an excellent screen, too, covering 100% of the DCI-P3 gamut with an average Delta E of 0.59. Nor do I have any complaints about a peak brightness of 467cd/m².

Well connected

Lenovo sensibly invests money into the 5MP webcam, which produces strong detail and colours even in low light. The noise suppression is overly keen, with a low hum even in quiet environments, but your voice will be



captured clearly. You'll need to flip the screen into portrait mode if using the webcam in all-in-one mode, as the camera sits on one of the short edges (which makes sense in laptop mode).

The speakers have their limitations. For instance, in "Englishman in New York", Sting's vocals came through clearly – until they were trampled by the percussion. Those with audiophilic tendencies won't be impressed, but the X1 Fold 16 is fine for background music while you work.

There's no room for USB-A ports in such a skinny frame, but you do get two Thunderbolt 4 ports and a third USB-C port that supports up to 10Gbit/sec transfers. As you'd expect for a product announced 18 months ago there's no Wi-Fi 7, but Wi-Fi 6E is always welcome.

Final flip

Lenovo might argue that the Zenbook 17 Fold isn't a fair comparison. That's a consumer device, and it only comes in one configuration (i7-1250U, 16GB RAM, 1TB SSD, Windows 11 Home), whereas the X1 Fold's specs can be tweaked.

The cheapest version of the X1 Fold 16 – with a Core i5-1240U, 16GB of RAM, 256GB SSD and Windows 11 Home – costs £4,119. In reality, however, nobody will pay that amount. Sign up to

ABOVE The folding stand transforms the X1 Fold 16 into an all-in-one PC

LEFT The bundled Precision Pen has 4,096 pressure levels

Lenovo's site and you can claim a 10% discount, and that cuts the price to £3,707. Not that I think anyone should buy that configuration, either: the X1 Fold 16 with a Core i7-1250U, 1TB SSD, Windows 11 Pro costs £4,349, or £3,914 after the discount.

That's still far more than the Zenbook, but Lenovo's machine comes with a three-year collect-and-return warranty (the Asus machine is covered for one year with no way to extend it), and the X1 Fold can be easily managed by businesses thanks to Lenovo's mature Vantage software.

Lenovo has also certified its foldable to MIL-SPEC 810H, so I would feel more confident about its longevity. That's important as this laptop isn't designed for repair (or upgrades) with the 16GB of RAM soldered on.

I also prefer Lenovo's design, by a distance. Not only is it much sleeker and lighter than the Zenbook, but it has a fabric finish to the rear that looks as good as it feels.

However, there's a sting in the tail: the Zenbook 17 Fold now costs £2,300 due to heavy discounting. Whichever way you cut it, the X1 Fold 16 is at least 50% more expensive. It's a great machine, but is it worth the extra? You probably don't need to wait for my answer. **TIM DANTON**

SPECIFICATIONS

10-core (2 P-core, 8 E-core) Intel Core i7-1250U processor • 16GB LPDDR5-5200 RAM • Intel Iris Xe graphics • 16.3in 2,560 x 2,024 60Hz OLED touchscreen • 512GB M.2 PCI-E Gen 4 SSD • 5MP webcam • Wi-Fi 6E • Bluetooth 5.1 • 2x Thunderbolt 4 • USB-C 3.2 Gen 2 • 64Wh battery • Windows 11 Pro • Lenovo Precision Pen • unfolded, 345 x 276 x 8.6mm (WDH) • folded, 276 x 176 x 17.4mm • 1.3kg (1.9kg with keyboard) • 3yr C&R warranty





Asus Zenbook Duo UX8406 (2024)

A dual-screen laptop that almost matches the ThinkPad X1 Fold 16 for utility but at half the price

SCORE ★★★★☆

PRICE As reviewed, £1,667 (£2,000 inc VAT) from asus.com/uk

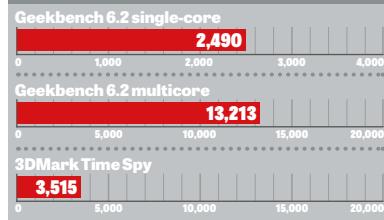
As the Lenovo ThinkPad X1 Fold 16 (see p58) proves with some vengeance, foldable tablets are expensive and relatively low-powered. So, what if you only have £2,000 to play with, still want to indulge in dual-screen action and fancy one of Intel's new Core Ultra processors? The answer, as I suspect you've guessed, is the latest iteration of Asus' Zenbook Duo range.

Just like the X1 Fold, it can be used as a laptop and quasi-all-in-one PC. You could even, at a push, use it as a giant ebook, while the bundled Asus Pen 2 sits at the ready if you wish to scrawl notes, draw or annotate. The difference is that here Asus provides two flat screens, which comes with obvious drawbacks and a handful of less obvious advantages.

Room for one on top

It's easy to understand the Zenbook Duo if you think of it primarily as a laptop. An attractive one, too, with a subtle geometric pattern on its lid and an all-metal chassis. To the untrained eye, it looks

BENCHMARKS



exactly like any other premium laptop, as the keyboard blends seamlessly into the design when locked magnetically in place. The keys have roughly the same travel as you'd expect on a normal laptop, and

even though this keyboard can't match the X1 Fold's for feel or layout (the Enter height is single-height, the cursor keys are clustered together, and the hash key is in a weird position) I would give the Zenbook Duo's keyboard a solid B overall.

But of course, this is a laptop in disguise: ripping off its keyboard (I'm channelling Scooby-Doo at this point) reveals a second screen beneath. And instead of the base of the laptop being a flat surface, it has a kickstand built in. Or perhaps more accurately, bolted on, as it stands around 1mm from the base.

The design is most kindly described as utilitarian, with the stand being made of metal, apart from a coating of a carbon-fibre-like substance at the bottom to prevent it from sliding. The approach is ugly but effective, keeping the Zenbook locked in position at a variety of angles.

The biggest advantage over the X1 Fold, and Asus' own Zenbook Fold 17 (see issue 338, p50), is that when on the move it folds down to the size of

ABOVE Taking off the detachable keyboard reveals the second screen beneath

"It's easy to understand the Zenbook Duo if you think of it primarily as a laptop. An attractive one, too"

LEFT The two 14in displays are both high-quality affairs

a 14in laptop. Inevitably, the Duo is thicker than a "normal" 14in laptop, measuring roughly 22mm if you include the stand or the feet at the rear (Asus doesn't in its official measurements). It's heavier, too; even the convertible HP Spectre 14 (see p62) weighs 1.4kg compared to 1.7kg for the Duo once you include the keyboard.

Dual-screen action

Strip off the keyboard, kick out the stand, and you arguably have a dual-screen PC. It's just that both screens are relatively small, with a 14in diagonal, so unlike the folding alternative it feels more akin to working on a laptop with a second screen hovering magically above it. There are plus points to this, such as when you're typing away on the bottom screen and using the top one for reference

– or perhaps for coders who like to have the IDE sitting separately – but I prefer the flexibility of having one giant screen.

The other obvious difference is that there's real estate between the panels. The precise difference will depend upon the angle at which you position the top panel, but think an inch and

you won't be far wrong.

This gap becomes a bigger issue if you decide to use the screens side by side, but I was never happy with this configuration; you either need to sit the screens completely

upright or push them back with the kickstand fully extended, and then one side is slightly higher than the other. Not great.

There's one final mode Asus mentions, which is sharing mode. So if you were giving a presentation to



RIGHT With the keyboard attached, the laptop looks much like any other

someone sitting opposite you then you could lay the screens flat and they would see exactly what you see, or you could show them something different but the orientation would be correct from their point of view. It's clever and may have hidden uses I can't think of, but I would be more impressed if the hardware supported a tent mode. That way you could also play *Battleships*.

Software extras

You select sharing mode with Asus' ScreenXpert software, which (when active) sits discreetly in a corner of the screen as a transparent icon. Press on this and options appear, such as switching off the bottom screen, locking screen rotation and jumping into settings. You can also create task groups, which launch a preset collection of apps in the windows and orientations you desire.

And Asus doesn't stop there in its attempt to improve the dual-screen "user experience". For instance, let's say you forget the keyboard or it runs out of battery (it uses Bluetooth and must be periodically charged via USB-C). Tapping six fingers on the bottom screen summons the Zenbook's virtual keyboard, which can fill the whole of the screen or half of it. It's a nice idea, but it's also unsettling to use as there's no tactile feedback; I gave up within a minute.

I did enjoy the "windows flick", however, where you select an open program and flick it to the other screen. And if you want this on steroids then select the program and wait for a nanosecond. A floating menu appears with icons for screen one (the top one), screen two and a split screen option. Drag the program into screen one on the menu and you get options for where you want to put it, such as full-screen, filling half the screen or one quadrant of it. It's far more intuitive than this description makes it sound.

Other pluses

Compared to folding PCs, the biggest benefit of the Duo's approach is that its specs are far more up to date and much faster. Asus sent us the Core Ultra 9 version, which destroys its rivals in every benchmark. That isn't a great surprise as it includes six P-cores, eight E-cores and two LE-cores (16 in total), compared to two P-cores and eight E-cores for the Core i7-1250U.

In Geekbench 6.2, it was almost twice as fast in the multicore test, returning 13,213 to the Lenovo X1 Fold's 7,765. Likewise in Cinebench R23, with 12,374

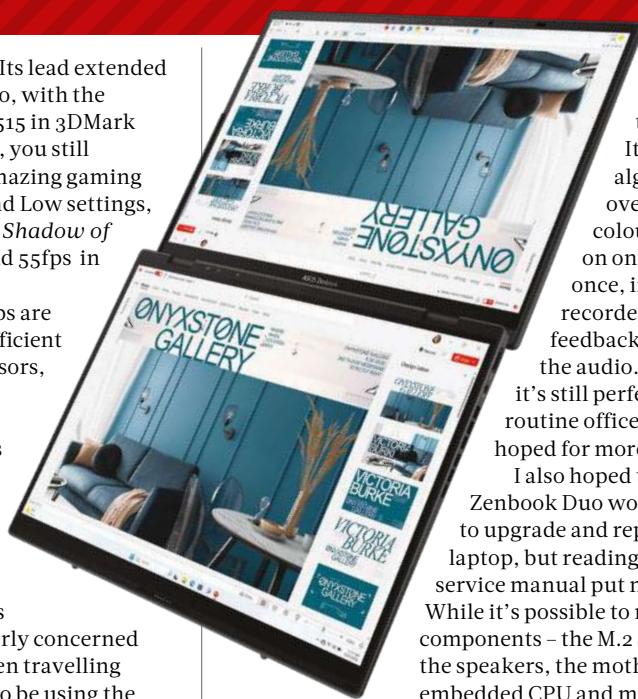
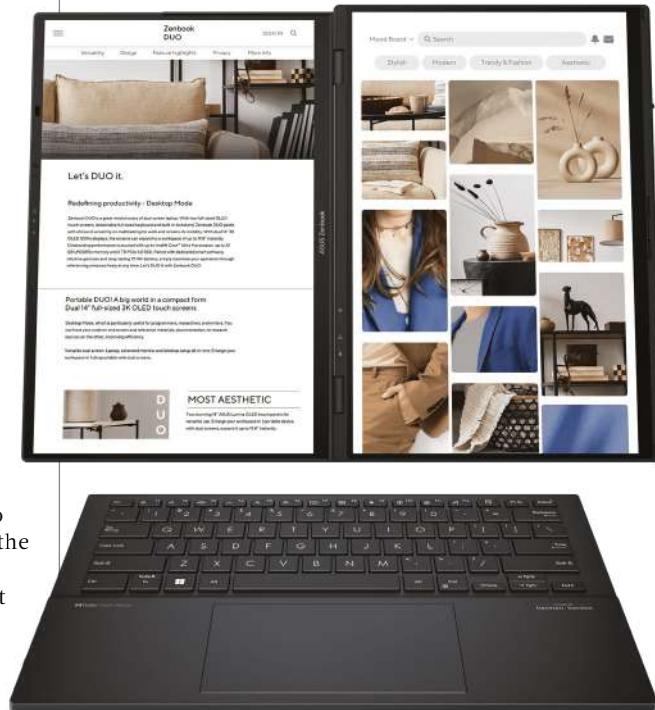
compared to 6,228. Its lead extended into our 3D tests, too, with the Zenbook scoring 3,515 in 3DMark Time Spy. However, you still shouldn't expect amazing gaming speed: at Full HD and Low settings, it averaged 34fps in *Shadow of the Tomb Raider* and 55fps in *Metro Exodus*.

Intel's latest chips are also more energy-efficient than their predecessors, with the laptop stretching to 11hrs 22mins in PCMark's Modern Office test. That was in laptop mode, though; switching to the dual-screen setup reduced that to 8hrs 34mins. I'm not overly concerned by that drop, as when travelling you're more likely to be using the Zenbook in laptop mode.

Those results came with the screens at 150cd/m², but both can reach almost 400cd/m² and provide excellent colour coverage: 100% of the DCI-P3 space with an average 0.42 Delta E. With a solid pair of speakers, you'll be happy watching films and listening to music on this laptop.

Almost regular

I thought the latest generation of Intel chips might also lead to Wi-Fi 7 inside, but you must make do with Wi-Fi 6E. There's no Ethernet port here either, but with an HDMI 2.1 output (supporting 4K screens at up to 144Hz), two Thunderbolt 4/USB-C 4 ports and a USB-A 3.2 Gen 1 port, connectivity is a definite plus point compared to the bendy PC rivals.



ABOVE Sharing mode could be useful in presentations

"Both screens can reach almost 400cd/m² and provide excellent colour coverage: 100% of the DCI-P3 space"

BELOW Desktop mode takes full advantage of the dual screens

I'm less enamoured by the webcam. Its sharpening algorithm is overzealous, colours subdued and on one occasion (only once, in its defence) it recorded odd, amp-feedback-like buzzing in the audio. This bug aside, it's still perfectly fine for routine office calls, but I hoped for more at this price.

I also hoped that the Zenbook Duo would be as easy to upgrade and repair as a normal laptop, but reading through the service manual put me right.

While it's possible to replace most components – the M.2 SSD, the battery, the speakers, the motherboard (with embedded CPU and memory), even the screens – it's a job for professionals. Preferably ones with good insurance. At this point I will draw your attention to the single year of collect-and-return cover, which isn't terribly reassuring for a machine of this complexity or cost. There's no way to extend this at point of purchase, either.

That matters when you're spending this much, with the cheapest Zenbook Duo costing

£1,700 inc VAT. That will be exclusive to Currys and includes a Core Ultra 7, 16GB of RAM and 1TB SSD; our test unit, the UX8406MA-PZ203W, has the top specs of a Core Ultra 9, 32GB of RAM and 2TB of storage.

At first, I wasn't wowed by the latest Zenbook Duo. Compared to the Lenovo X1 Fold 16, even Asus' own Zenbook Fold 17, it seemed clunky. And if they were the same price and the same speed, I would definitely opt for the extra flexibility provided by Lenovo's offering.

However, the Zenbook Duo needs to be thought of as a laptop with a bonus second screen. If you think you'll frequently take advantage of that, then it's a clever solution without a hideous price. **TIM DANTON**

SPECIFICATIONS

16-core (6 P-cores, 8 E-cores, 2 LPE-cores) • Intel Core Ultra 9 185H processor • Intel integrated Arc graphics • 32GB LPDDR5X-7476 RAM • 2x14in 120Hz OLED touchscreens, 2,880x1,800 resolution • 2TB M.2 PCI-E Gen4 SSD • Wi-Fi 6E • Bluetooth 5.3 • 1080p IR webcam • 2x Thunderbolt 4/USB-C 4 • USB-A 3.2 Gen 1 • HDMI 2.1 • 3.5mm jack • 75Wh battery • Asus Pen • Windows 11 Home • 314 x 218 x 14.6–19.9mm (WDH) • 1.7kg (1.4kg system, 300g keyboard) • 1yr RTB warranty • part code, UX8406MA-PZ203W

HP Spectre x360 14 (2024)

The Core 7 Ultra shines in this luxury laptop thanks to speed, superb battery life and a gorgeous OLED screen

SCORE ★★★★★

PRICE As reviewed, £1,583 (£1,899 inc VAT) from hp.com/uk

HP's latest Spectre convertible is a pricey proposition – you could buy a decent laptop plus a separate tablet for the same cost. But if you're looking for something that can fulfil both roles, this powerful, premium computer is a delight.

The two-in-one design doesn't compromise the aesthetics at all. Its deep blue chassis stands out tastefully from the swamp of monochrome laptops, while sliced-off corners give a pleasing minimalist aesthetic, as do the thin bezels around the display. In tablet mode, magnets hold the screen secure against the chassis, and despite the 14in screen it's not too heavy to carry around at 1.4kg. My one reservation about the design is a lack of ports: you get one USB-A port on the right-hand side, two USB-C ports on the left – and that's it.

The keyboard has a comfortable layout and I quickly found myself typing at full speed, enjoying the action as my fingers bounced positively from each keystroke to the next. The haptic touchpad simulates clicking by producing a vibration; I can take or leave this, but I definitely like its smooth texture.

The star of the design is the 14in, 2,880 x 1,800 OLED touchscreen. On paper it



Gathering Storm benchmark, it

doesn't appear all that exceptional: it covers 86% of the DCI-P3 colour gamut with an average peak brightness of 366cd/m². However, it delivers wonderfully vibrant colours, making games and videos look much richer, brighter and more solid than the numbers would suggest.

Tucked above the display sits a surprisingly good webcam. Excellent, in fact. Unusually, it offers an Ultra HD, 4K resolution, and image quality is a cut above most rival laptops: my cheeks looked rosy, my surroundings looked bright and colourful, and somehow the windows behind me weren't blown out.

Audio performance is pleasing, too, thanks to a pair of top-firing speakers. I listened to "This Feels Like the End" by Nothing But Thieves and immediately got into the groove.

The opening percussion was thumping, vocals were crisp and loud and the guitar chords and riffs were bright and urgent.

The basic Spectre x360 14 comes with an Intel Core Ultra 5 125H CPU, 16GB of RAM and a 512GB SSD for £1,499 inc VAT, but I

reviewed the premium model with a Core Ultra 7 155H, 32GB of RAM and 2TB of storage. Unsurprisingly, this high-end hardware let me open dozens of Chrome tabs and a handful of YouTube videos all at once, without the slightest stutter. In Geekbench, the Spectre scored a soaring 12,358, even outpacing the M3 MacBook Pro's score of 11,968 (see issue 352, p46).

The one area of compromise is graphics performance. The HP Spectre x360 14 relies on an integrated Intel Arc GPU, and in the Civilization VI:

ABOVE A vibrant OLED screen and a superb keyboard give the Spectre a luxury feel

averaged a merely acceptable 36fps at 1080p. In other words, it's fine for casual titles, but hardcore gamers will demand something more capable.

A final strength is battery life. With a power-efficient processor and no separate GPU to drive, the Spectre x360 14 lasted 11hrs 1min of web surfing, longer than almost any Intel laptop we've previously tested – although the M3 MacBook Pro lasted a ridiculous 17hrs 16mins. Heat is

well managed, too: after

15 minutes of video streaming, we measured a maximum temperature of 39°C on the underside of the chassis, which is on the warm side but easy to live with if you want to use the Spectre on your lap.

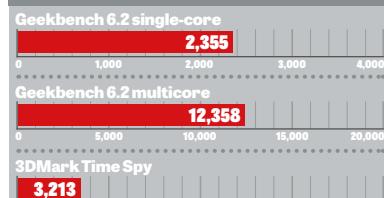
The new HP Spectre x360 14 is hard to fault. It's a fast, beautifully designed laptop, with a sumptuous screen, excellent performance and battery life, and the convenience of tent and tablet mode. Gamers will want a more powerful graphics chip, but as a general-purpose productivity and entertainment companion, this laptop is a star that manages to justify its high price. **RAMIT TABARI**

LEFT Whether it's in tent, laptop or tablet mode, the Spectre is a joy to use

SPECIFICATIONS

16-core (6 P-cores, 8 E-cores, 2 LPE-cores)
Intel Core Ultra 7 155H processor • Intel integrated Arc graphics • 32GB LPDDR5X-7467 RAM • 14in 120Hz OLED touchscreen, 2,880 x 1,800 resolution • 2TB M.2 PCI-E Gen4 SSD • Wi-Fi 7 • Bluetooth 5.4 • 9MP IR webcam • 2x Thunderbolt 4/USB-C 4 • USB-A 3.2 Gen 2 • 3.5mm headphone jack • 68Wh battery • HP Tilt Pen • Windows 11 Home • 314 x 220 x 16.9mm (WDH) • 1.4kg • 1yr RTB warranty • part code 9D0J3EA#ABU

BENCHMARKS



BATTERY LIFE



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£499.99



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MOB ASUS PRIME H510M-A
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HDD 1TB Sata3 HDD
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GPU Intel Integrated HD630
CAS Fractal Core 1100
PSU 500W PSU
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MOB ASUS PRIME B660M-A WIFI D4
RAM 16GB DDR4 3200Mhz
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Samsung Galaxy Book4 Pro 16in

This premium 16in laptop gives the MacBook Pro 16 a run for its money, despite being significantly cheaper

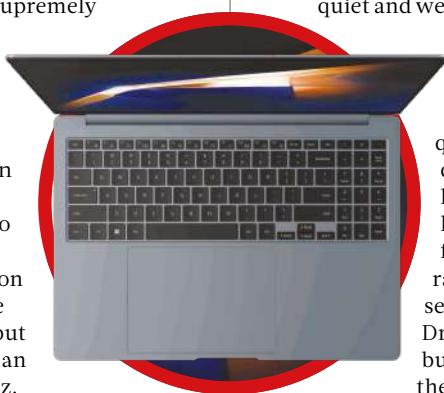
SCORE ★★★★★

PRICE 512GB, £1,416 (£1,699 inc VAT) from samsung.com/uk

Glance at the Galaxy Book4 Pro 16in and you may be fooled into thinking it's the 16in MacBook Pro (see issue 342, p48). It channels the same industrial chic, with a metal shell barely interrupted by design touches – unless you count a discreet Samsung logo on the lid – while a huge touchpad dominates the space below the keyboard. But it doesn't take long to spot the differences, starting with price: the Book4 Pro starts at £1,699, compared to £2,599 for its rival.

This is also a supremely sleek laptop, measuring 12.5mm from top to bottom. Despite this, Samsung packs in a great selection of ports, with two Thunderbolt 4/USB-C 4 sockets on the left alongside an HDMI 2.1 output that can support an 8K screen at 60Hz. On the right you'll find a USB-A 3.2 Gen 2 port, microSD card and a 3.5mm headphone jack, with Wi-Fi 6E fulfilling network duties.

For better or worse – your view is likely to be swayed by whether you use it regularly – Samsung also includes a number pad. That makes sense in terms of the chassis' 355mm width, but it pushes the trackpad to



the left and spoils the otherwise symmetric design. But what a trackpad: a glass coating keeps things smooth, clicks are physical rather than haptic, and its huge size (150 x 108mm) is ideal for gestures. In fact, it's almost too large: I switched it off while typing due to poor palm rejection.

The keyboard is one of the best you'll find on a laptop. It doesn't have deep travel, but keys are dampened, quiet and well spaced, so I had no trouble hitting high typing speeds. The only questionable decision is to use half-height cursor keys with function doubling rather than having separate Pg Up, Pg Dn, Home and End buttons (although these are scattered around the number pad too).

Samsung integrates a fingerprint reader at the top right of the keyboard, but the 1080p IR webcam is more convenient. And it's also excellent at its main duty of video calls. Detail capture proved exceptional, as were colours, and thanks to clear mics I would be happy to use the Book4 Pro in important meetings.

This being a premium Samsung laptop, the 2,880 x 1,800 touchscreen uses AMOLED technology. In its default colour mode, it covers 98% of the DCI-P3 gamut, while colour accuracy is near faultless, with an average Delta E of 0.32. A peak brightness of 398cd/m² is enough to be readable in almost any conditions, particularly with the Book4 Pro's

ABOVE The Book4 Pro offers power and quality at a good price



"A 120Hz panel means Windows feels slick, and this is no illusion. An Intel Core 7 155H processor means 16 cores sit at the ready"

LEFT The keyboard is among the best you'll find on a laptop

BELLOW The excellent selection of ports includes HDMI 2.1

new anti-reflective finish, and as soon as the Galaxy Book4 Pro detects direct sunlight it steps up the brightness even further.

A 120Hz panel means Windows feels slick, and this is no illusion. An Intel Core 7 155H processor means 16 cores sit at the ready, with six of them high-performance units. Despite the slim chassis, which makes cooling more difficult, this laptop thundered to 12,118 in

Geekbench 6.2's multicore test and returned 12,597 in Cinebench R23.

Intel's Arc graphics pushed it to a strong 3,751 in 3DMark Time

Spy, although it could only average 28fps in *Shadow of the Tomb Raider* at High settings and 1080p.

The downside to such a slim design is minimal upgrade routes. The Samsung PM9B1 SSD is extremely thin – so tricky to replace – but returned solid sequential speeds of 3,611MB/sec (reads) and 2,518MB/sec writes. Sadly, and predictably, the 16GB of RAM is embedded on the motherboard, with no option to buy more. In fact, your

only configuration choice is a 1TB SSD rather than a 512GB model, for which Samsung charges a startling extra £200.

If you're buying for business then you'll get more options, including

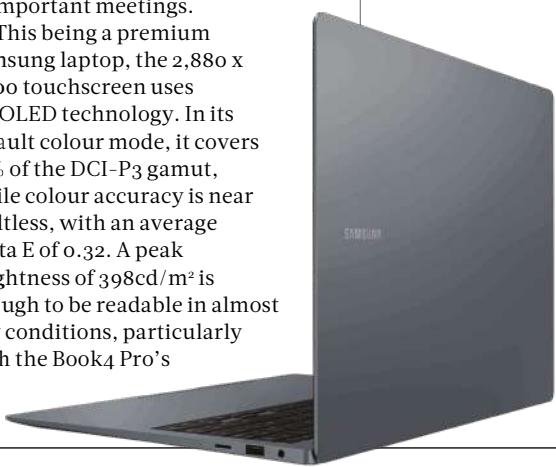
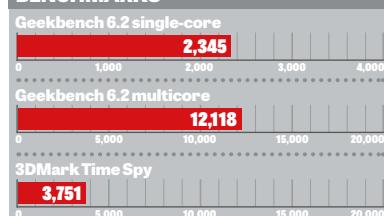
Windows 11 Pro rather than Home, and all models ship with Samsung Knox to add another layer of protection. While you get a single year of return-to-base warranty as standard, you can upgrade this to two years of accidental damage and theft cover for £100 at time of purchase.

But what really seals the deal for demanding users is this laptop's battery life. While the Book4 Pro isn't super-light at 1.6kg, the shortest time it lasted in PCMark's suite of rundown tests was 12hrs 19mins. Factor in this laptop's price, its speed and its quality, and this is the best all-round 16in Windows laptop you can currently buy. **TIM DANTON**

SPECIFICATIONS

16-core (6 P-cores, 8 E-cores, 2 LPE-cores) • Intel Core Ultra 7 155H processor • Intel integrated Arc graphics • 16GB LPDDR5X-7267 RAM • 16in 120Hz OLED touchscreen, 2,880 x 1,800 resolution • 512GB M.2 PCI-E Gen4 SSD • Wi-Fi 6E • Bluetooth 5.3 • 1080p IR webcam • HDMI 2.1 • 2x Thunderbolt 4/USB-C 4 • USB-A 3.2 Gen 2 • microSD card slot • 3.5mm headphone jack • 76Wh battery • Windows 11 Home • 355 x 250 x 12.5mm (WDH) • 1.6kg • 1yr RTB warranty

BENCHMARKS





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Every week the team gives its hot take on the news and delivers a verdict on the hot hardware. With a rotating cast of Tim Danton, Jon Honeyball, Darien Graham-Smith, Barry Collins, Lee Grant and Rois di Thuama, you're guaranteed informed opinions and many appalling jokes.

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this month
£169

We scour the globe to negotiate the best software deals for our readers, from extended licences to full programs you don't need to pay a penny for. Here's this month's lineup

DiskImage 18 Professional

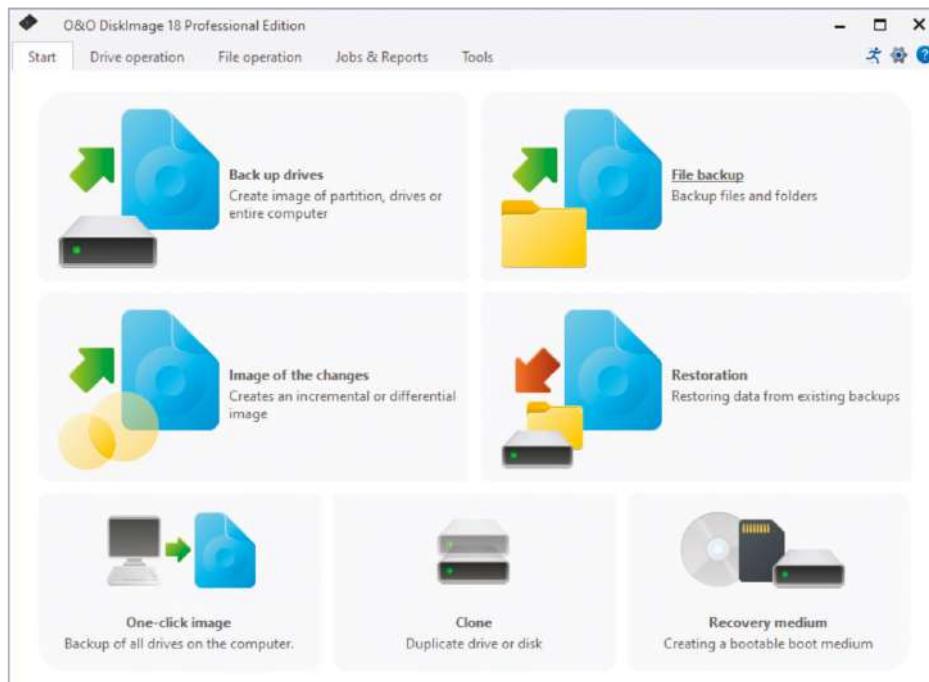
If you've ever suffered the shock of data loss or had to spend hours recovering your system after a crash or drive corruption, you'll already know how important it is to make and maintain a regular backup. Ideally encompassing every aspect of your system, not just your work files and photos.

Having a fallback copy of Windows – including all your favourite apps and settings, along with your irreplaceable documents, media and other files – is a no-brainer. But with so many options, what's the best way to set this up?

O&O DiskImage Professional features all the tools you need for backing up individual files and folders, and creating images of entire partitions and drives. Hints and tips guide you through the process of protecting your data, and the latest version features a new Windows 11-style interface.

After installing and launching the suite, you can get started by clicking on the appropriate tile, such as drive imaging, file backup, one-click imaging or bootable recovery disk creation.

■ Full product, worth £36
■ oo-software.com
REQUIRES
Windows 10 or later; 250MB hard drive space; online registration

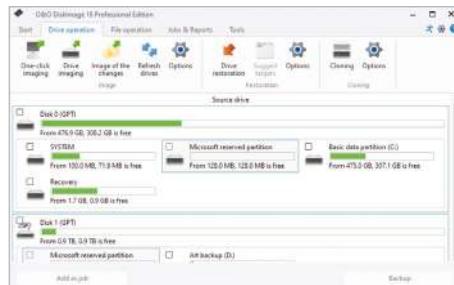


Choose the imaging option and you can create an image of any drive connected to your PC quickly and easily. Alternatively, select a source drive or volume and click "Start drive imaging" to make a full backup using the program's default settings.

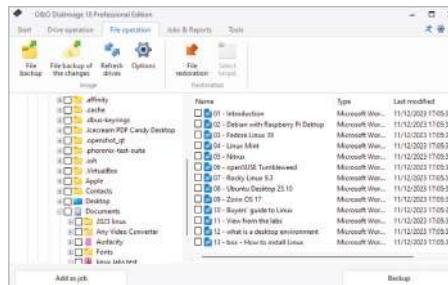
You can also back up individual files and folders. The process is immediately familiar, as you can browse through your files inside a File Explorer-type interface, and tick the ones you want to secure.

You can create a complete backup or save space with incremental or differential copying; you can also compress or encrypt your archives.

Once you've created your archive, DiskImage also offers all the tools you need to manage and restore your data. You can recover entire images or select individual files and folders, or even mount your image files in Windows, and access them like a regular external drive.



ABOVE You can easily create images of entire drives – or even multiple disks at once – and specify individual partitions to be backed up



ABOVE If you just want to back up the odd folder or a handful of items, you can select them from an intuitive file-selection interface



ABOVE Prepare for a disaster you hope will never occur by using DiskImage to create bootable recovery media

WinOptimizer 2024

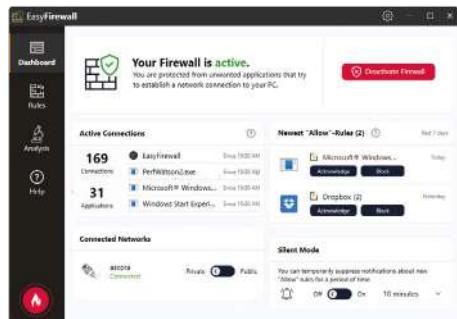
- Clean up, maintain and optimise your system; remove leftover Windows application files and browser traces
- Find and delete duplicate files, broken shortcuts and other space-hogging items
- Control startup programs, disable unneeded services and optimise your internet connection



■ Full product worth £25 ■ ashampoo.com
REQUIRES Windows 7 or later; 75MB hard drive space; online registration

EasyFirewall 2023

- Take full control of Windows' native firewall with this easy-to-use configuration tool
- Save resources that would otherwise be consumed if you were running a separate firewall
- Create your own rules to determine which programs can – and can't – transmit data over the internet



■ Full product worth £20 ■ abelssoft.net
REQUIRES Windows 10 or later; 75MB hard drive space; online registration

Audials Radio 2024 SE



■ Full product worth £10 ■ audials.com
REQUIRES Windows 7 or later; 3GB hard drive space; online registration

- Find and record online radio streams, and bookmark favourites for future listening
- Identify tracks and find past recordings to catch up on what you've missed
- Pool music from iTunes and other sources

Guardian Of Data



■ Full product worth £19 ■ ascomp.de
REQUIRES Windows 7 or later; 50MB hard drive space; online registration

- Encrypt documents directly from a context menu inside Windows File Explorer
- Create self-extracting encrypted archives
- Password-protect files with up to 256-bit encryption for complete peace of mind

SoftOrbits Screen Recorder



■ Full product worth £59 ■ softorbits.com
REQUIRES Windows 10 or later; 2GB hard drive space; online registration

- Click the button on the floating toolbar to record anything that happens on your screen
- Capture a specific area or the whole screen, then share the recording with colleagues
- Perfect for training videos or technical support

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pcprodownload.co.uk



Framework Laptop 16

The best laptop on the market if you care about sustainability, upgradability, your right to repair – and gaming

SCORE ★★★★☆

PRICE Performance Pro with graphics, £1,791 (£2,149 inc VAT) from [frame.work](#)

The Framework Laptop 16 defies categorisation. It's a gaming laptop, unless you decide not to choose discrete graphics, in which case it's a productivity workhorse.

Even then you have decisions to make. Which keyboard? Should you choose a number pad? Perhaps an RGB macro pad? What about spacers, ports, storage? This is simply the most customisable laptop I've seen.

There are two drawbacks, starting with the price. But all the various input options, expansion choices and graphics swaps make specifying the Framework Laptop 16 a complicated

matter. For *PC Pro* readers familiar with the inner workings of PCs this won't be a problem, but

Framework is hitting the point where you need a degree of expertise or you could make a costly mistake.

Start with the basics

As always with Framework, you can either build the laptop yourself – and bring your own OS – using its DIY Edition, or opt for a pre-built model. The former starts at £1,399, the latter at £1,699.

If you opt for pre-built, you have three options: Performance, Performance Pro (which, for an extra £50, includes Windows 11 Pro) or Overkill for £2,099. Both Performance models have the same core spec of an AMD Ryzen 7 7840HS, 16GB of memory and 512GB of storage. Overkill ups the ante with a Ryzen 9 7940HS, 32GB of RAM and a 1TB SSD.

Framework sent us its £1,749 Performance Pro configuration, but with the Graphics Module containing a discrete AMD Radeon RX 7700S chip, which adds £400 to the price.

So our test system costs £2,149, but that's before adding any extras. As part of the price, you get six USB expansion cards to slot into the six bays built into the side of the chassis,



ABOVE It's possible to replace and repair every part of this laptop yourself

and if you stick to USB-A or USB-C you won't pay any extra. Want HDMI, a DisplayPort, microSD card or an audio jack?

Those cost an extra £10 apiece. And if you want Ethernet you'll pay £30 more.

You can also order storage expansion cards, with 256GB (£45) or 1TB (£125) options available. In short, this is a smorgasbord of a laptop for you to kit out as you wish.

Choose carefully, though. You can only charge from the back four ports, while only three of the six ports support display output. And USB-C works in any port, but only the back two allow full USB 4 speeds.

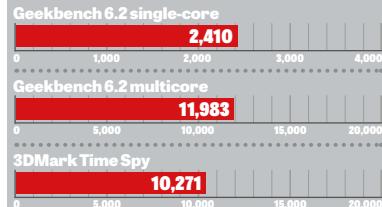
“Which keyboard? Should you choose a number pad? An RGB macro pad? This is simply the most customisable laptop I’ve seen”

Key decisions

At this point, it won't surprise you that the choice of keyboard and touchpad modules on the Framework Laptop 16 depend on you. Your choices, however, must include a keyboard module, touchpad module and spacers, with the possibility of a number pad, macro pad and LED Matrix spacer as extras.

Framework expects you to work out where to put the keyboard. It could be central, with two spacers on either side. Or perhaps you're

BENCHMARKS



BATTERY LIFE



left-handed and would prefer to put the number pad there. Just as importantly, if one of these parts dies, it's easy to replace.

There are a load of options to pick from, and Framework is happy to sell them to you. An RGB backlit keyboard – US English only, for now – costs £50. A number pad module is £39, while an RGB macro pad is an extra £79. This macro pad offers 24 programmable RGB backlit keys that you can configure how you like in software.

And there's more. While black spacers for the keyboard come standard, you can switch to orange, grey or lavender for £5 a pop. Or go wild and buy the LED Matrix design for £39 each. The downside of this modularity is that there are seams; while everything is guided by magnets and fits snugly, you can see where the modules and spacers are separated.

The keyboard and macros are controlled by the open-source software VIA, and while Framework uses a simplified, browser-based version, there's still a learning curve. Framework needs to work on this: it should be far easier to program the RGB macro pad, for instance.

My other gripe is about the keyboard. Framework says the keys offer 1.5mm of travel, but they were too mushy for my taste. If only Framework offered a ThinkPad-like keyboard option.

■ Upgradeability

While shuffling around the Framework's modular input mechanisms is easy enough, actually getting into the device is harder than on the Framework Laptop 13 (see issue 346, p46). After removing all of the input modules, you have to pull a cable in the metal plate, helpfully labelled number 1. From there, you can use a T5 screwdriver (one comes with the laptop) to remove 16 captive screws labelled 2 to 17.

Our pre-built model came with a single 512GB M.2 2280 SSD installed. If you want to add another, there's room for a smaller M.2 2230 SSD underneath. The DDR5 memory is upgradable, as is the battery and, in theory, the motherboard (this is also your route to future CPUs). The other upgrade is the GPU, but at the moment the Radeon RX 7700S is your only option. I'd like to see Nvidia get involved, but Framework is making no promises.

You can also buy the laptop with both the Graphics Module and the Expansion Bay Shell. The idea is that if you want to travel lighter, you can swap the shell with the graphics module. However, it's a trickier process than it should be.

Frequent travellers will probably make the effort, though, as even



without the Graphics Module the laptop weighs 2.1kg. With it, that goes up to 2.4kg, and the height at the back increases from 18mm to 21mm.

■ Speed boost

Framework's 16in anti-glare display comes with a 2,560 x 1,600 IPS panel, and it performed well in our technical tests. It covers 75% of the DCI-P3 gamut with a peak brightness of 485cd/m² and an average Delta E of 0.21. There's also an anti-glare coating, which is better for work than for games or watching films.

Still, when I started testing with one of my favourite games, *Control*, it looked great. The game features a lot of red lighting, which looked bright and vibrant on the Framework

ABOVE You can buy a pre-built Framework Laptop if you prefer

"While the Framework Laptop 16 isn't for everyone, it offers tech enthusiasts the chance to build their dream laptop"

BELLOW The choice of keyboard and touchpad modules is up to you

Laptop. The pair of speakers sound good, too, only lacking in bass.

As for speed, I started at 1,920 x 1,200 on High settings with medium ray tracing presets, where the game ran between 40fps and 48fps but with several stutters. Cutting ray tracing and dropping to Medium settings kept me more reliably above 50fps, albeit again with a few hiccups. The fans were spinning loudly during gameplay, keeping the system cool.

Those aren't great results, especially compared to laptops with an RTX 4070 – which now cost less than £1,500. For example, on *Shadow of the Tomb Raider*'s highest settings, the Framework reached 86fps at

1080p and 49fps at the panel's native resolution of 2,560 x 1,600. An RTX 4070 system scored 104fps and 60fps respectively.

It's a similar story for productivity performance. Although the Ryzen 7

7840HS is a fine processor, with eight high-performance cores and 16 threads, a glance through these pages will review cheaper laptops that outperform it. Bearing in mind this is a laptop with gaming skills, however, it was great to see battery life of 8hrs 49mins in our web-surfing test.

■ Final word

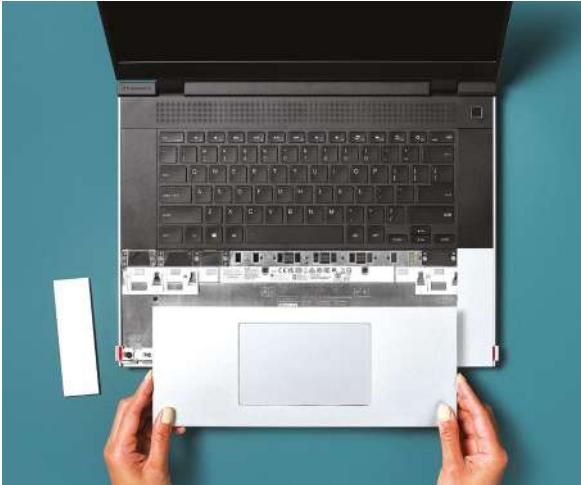
While I have my criticisms of the Framework Laptop 16, then, it's obvious in so many ways that this is a company with ethics at its heart. That stretches to the 1080p webcam, which produces good detail and colours but also features a switch next to it that turns it off. There's another switch for the microphone, too.

Then there's its approach to materials: the cover is made from 75% post-industrial recycled (PIR) aluminium, the bottom cover is 90% PIR aluminium, shipping is fully carbon offset and the packaging is 100% recyclable. Framework is setting the standards for others to follow.

While the Framework Laptop 16 isn't for everyone, it offers tech enthusiasts the chance to build their dream laptop – provided that the dream involves a 16in screen and all-AMD parts. **ANDREW E FREEDMAN**

SPECIFICATIONS

8-core/16-thread AMD Ryzen 7 7840HS processor • 8GB AMD Radeon RX 7700S graphics • 16GB DDR5-5600 RAM • 16in 165Hz IPS non-touch panel, 2,560 x 1,600 resolution • 512GB M.2 Gen4 SSD • Wi-Fi 6E • Bluetooth 5.2 • 1080p webcam • 6 x user-selectable expansion cards • 3.5mm jack • 85Wh battery • Windows 11 Pro • 357 x 270 x 21mm (WHDH) • 2.4kg • 2yr limited warranty. **Expansion card options:** USB-A or C (£9) • HDMI (£19) • 1GbE port (£39) • DisplayPort (£19) • microSD (£19)





Honor Magic V2

The best foldable phone by a distance thanks to its skinny design and superb value (once you include discounts)



SCORE ★★★★☆

PRICE £1,417 (£1,700 inc VAT)
from [honor.com/uk](https://www.hihonor.com/uk)

Honor has kept us waiting for the Magic V2, launching it in China way back in July 2023. I suspect it has spent much of that time refining the software that folding phones need to make them worthwhile, and while Honor still falls behind Samsung for slickness, the Magic V2 offers one big compensation: its compactness.

Because the Magic V2 is light years ahead of its key rival, the Galaxy Z Fold5 (see issue 349, p68), in terms of slimness and weight. A fact made even more stark for me as I had been using the Fold5 for several weeks before the Honor Magic V2 arrived for testing.

■ It's a phone, Jim

The biggest difference between the two is that the Honor feels like a normal phone when folded. I'm talking about two key factors here: one, its full-size front screen compared to Samsung's skinny offering; two, it's slim and light enough to feel like a larger "normal" phone such as the Galaxy S24+ (see p72) or the iPhone 15 Pro (see issue 351, p62) when stashed in a pocket. It's true that both those phones are a couple of millimetres slimmer than the Magic V2, but whereas I always

felt the weight and girth of the Fold5, I barely noticed the V2.

One reason I appreciate the Magic's wider front screen is that it means the onscreen keyboard is bigger and the keys are much easier to hit. I often struggle to hit the right key with the Fold5, to the extent that I stopped playing an online word game as my times slumped. Just as importantly, there's more space to view apps and articles, and much (probably most) of your time will be spent using the V2 in folded rather than unfolded mode.

■ Unfolded experience

The other benefit of being wider is apparent when you open up the screen. A difference of 0.3in – the Magic V2's unfolded display measures 7.9in, the Fold5's 7.6in – may not sound much, but place them side by side and you will have no trouble spotting which is larger. As a minor example, an 11-page chapter of a Kindle book on the Fold5 became a 10-page chapter on Honor's device.

Honor has done a solid job of adding its own enhancements to Android 13 – not 14 yet – that make using the V2 in unfolded mode more useful. There's a learning curve, but you'll soon get used to swiping from the left or right – and then holding

ABOVE Ignore the headline price: after discounts, it's £1,400

still for a split second – to bring up a bunch of shortcuts. Likewise that tapping on the short grey bar at the top of the screen gives you the option of turning the active app to full-screen, half-screen or windowed mode.

What I like most about Honor's MagicOS overlay, however, is that it doesn't try to usurp Google. Swiping right from the homescreen brings up the Google news feed rather than Honor's own, for instance, and while there's the usual scattering of home-made apps – including the Honor App Market – I never found it obnoxious.

Where MagicOS falls behind Samsung is ease of navigation and the lack of a desktop environment. Fans of Samsung's DeX love its ability to display a Chromesque desktop with windowed apps, which appears if you connect a display over USB-C. Add a keyboard, use the phone as a touchpad, and away you go.

Honor says it will provide three years of Android updates (taking it up to Android 16) and five years of security updates, which roughly matches Google's Pixel Fold (see issue 348, p44) but falls a year short of the Fold5's four years of Android updates (and it's already on Android 14). Also note that the Magic V2 offers no water-protection guarantee, whereas the Fold5 is water-resistant up to 1.5m for 30 minutes.



ABOVE The three rear cameras produce above average results

BELLOW The Magic V2 is slim, and fits in the pocket better than rival foldables



Screen tests

As with all foldable screens, you can see a crease down the middle of the Magic V2's main display at certain angles. However, the effect is less obvious than on the Fold5, and I barely noticed it. That's particularly true with pure white backgrounds, where the V2 excels in Vivid mode. Even though I measured its colour temperature at 6704K, rather than the 6500K at which whites look best, I would keep it in this mode all the time rather than Normal.

That's purely down to colour coverage. In Vivid mode, the panel covers 87% of the DCI-P3 gamut; in Normal, that drops to 70%. Samsung's Fold5 covers 100% of the DCI-P3 space, but to my eyes its colours look saturated (in the default Vivid mode at which I got this result). Films look great on both phones, while a solid, loud pair of speakers do justice to both dialogue and music.

Those colour coverage results are all for the internal screens, but it's a similar story for the front-facing panels. The Honor covers 89% of the DCI-P3 space to 100% for the Fold5, but what matters is that they're both great to look at even in harsh conditions. Honor says the V2 can hit 2,500cd/m² in bright sunlight, but in more standard use my tests maxed out at 550cd/m² – more than enough to read easily in every situation I faced.

Photo boost

I took a lot of photos with the Honor Magic V2, and nine times out of ten I was pleased with the results. And in terms of specs, it does its best in the space available. In the camera housing, which juts 2mm from the phone rear and only causes a minor wobble when you set the phone down, you'll find a 2.5x optical zoom on the 20MP camera, plus a 50MP main camera and a 50MP ultrawide lens.

There's no dedicated macro camera, but the macro option in the settings does a fine job. The software seamlessly takes control over which camera you use, with no obvious difference in colour reproduction between them. Colours are a tad oversaturated but more natural than Samsung's Fold5 (or indeed any of Samsung's phones), and it also took more realistic street scenes and portraits than its rival. Even the 16MP selfie camera takes high-quality shots in good light.

Of all the foldable phones, the OnePlus Open (see issue 351, p60) and Pixel Fold take more consistent pictures overall – the Pixel's AI skills are particularly evident in night-time scenes – but most people will be pleased with the Magic V2's results.

Turn of speed

One area where foldable phones are always a generation behind the latest flagships is silicon. Here, that means Qualcomm's Snapdragon 8 Gen 2 SoC, as found in countless high-end Android phones launched in early 2023.

Inevitably, that means it falls behind the Galaxy S24 and recent iPhones in the benchmarks: its single-core of 1,921 in Geekbench 6 is 14% slower than the S24, its multicore result of 4,338 over 35% behind. But is the Magic V2 slow? Absolutely not. The Honor Magic V2 is as slick as John Travolta's hair in *Grease*, and it will stay so until the end of its life.

If you're a stickler for security updates, that means 2029 as Honor is guaranteeing five years of those. The bigger threat is, inevitably, physical breakage. Although I'm confident that the titanium hinge will stay the course, and reassured by the presence of hardened glass (Honor's own, not Corning's Gorilla Glass), the lack of IP certification makes me nervous. Can it really last for five years of daily grind? Should I be

ABOVE The 6.4in front screen is one of the Magic V2's highlights

nervous that the warranty is a single year, and that the scratch-free screen warranty Honor offers is only for six months?

At least the battery should keep going for some time. Honor

spreads a total of 5,000mAh of capacity across two sleek units, and there's an entertaining – albeit Honor-sponsored – video where the JerryRigEverything YouTube channel assembles a Magic V2 from its component parts (tinyurl.com/355jerry). So, in the right hands, this phone should be repairable and the battery replaceable.

Time to buy?

The Honor Magic V2 isn't perfect. Samsung and Google's foldable phone software feels more mature, there's no wireless charging, and I

worry about how long it will last due to the lack of protection against water and dust. Despite this, I would rate the Magic V2 not only above the Galaxy Z Fold5 but also the Pixel Fold and OnePlus Open.

By far the biggest reason for this is its sheer slimness. Folded, it's 2mm skinnier than any of its rivals, and that makes a huge difference in the pocket. It also wins for screen size while matching the competition for speed and battery life.

Finally, Honor bags the honours for value. Subscribe at its website and you can claim £300 off the price of the V2, bringing it down to £1,400. That's £199 cheaper than the OnePlus (which has the same core specs), £449 less than the equivalent Fold5, and a match for the Google Pixel Fold now that it's on offer (the Pixel Fold 2 is rumoured to arrive this summer).

If you've been biding your time for a foldable phone, I see no reason to delay: the Honor V2 is the best of the crop, and the price – with the £300 discount – is right. **TIM DANTON**

SPECIFICATIONS

8-core (3.2GHz/2.8GHz/2GHz) Qualcomm Snapdragon 8 Gen 2 SoC • 16GB RAM • Adreno 740 graphics • 7.9in foldable 120Hz OLED screen, 2,156 x 2,344 resolution • 6.4in cover 120Hz OLED screen, 1,060 x 2,376 resolution • dual nano SIMs • 512GB storage • triple 50MP/50MP/20MP rear camera • 16MP front camera • Wi-Fi 7 • Bluetooth 5.3 • 5,000mAh battery • USB-C 3.2 Gen 1 connector • Android 13, MagicOS 7.2 • folded, 74 x 9.9 x 157mm (WDH) • unfolded, 145 x 4.7 x 157mm (WDH) • 237g • 1yr warranty





Samsung Galaxy S24 and S24+

Both phones are great choices in their own right, but the S24 offers better value if lesser battery life

SCORE ★★★★☆ **S24**

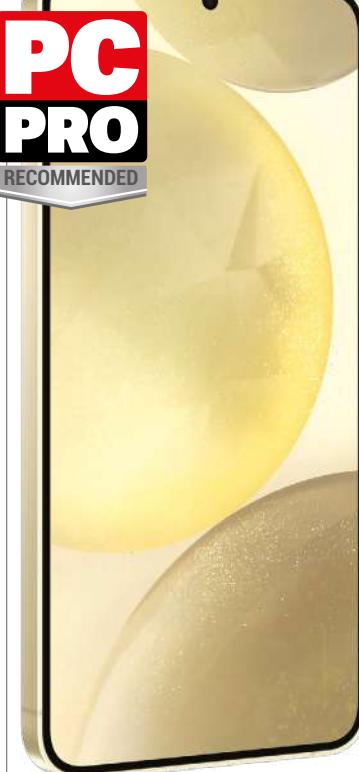
SCORE ★★★★☆ **S24+**

PRICE **S24:** 8GB/128GB, £666 (£799 inc VAT);
S24+: 12GB/256GB, £833 (£999 inc VAT)
from samsung.com/uk

The story of the Samsung Galaxy S24 series – including the S24 Ultra we reviewed last month (see issue 354, p58) – centres around Samsung's suite of AI-powered features. It's understandable, as AI is new and buzzy, and the Galaxy AI capabilities at the heart of the Galaxy S24 series are both practical and (with some exceptions) polished.

As with the S23 family, there's little difference between the S24 and S24+ other than their size. In terms of specs and camera setup they're identical, other than the S24 having less RAM and a smaller battery. They come in identical colours (including Sapphire Blue, Jade Green and the striking Sandstone Orange, which are exclusive to Samsung's online store) and are made of aluminium rather than the Ultra's titanium. Just like the S24 Ultra, you may find the S24+ tricky to use one-handed, but it never feels heavy.

At a glance you'd struggle to tell the S24 series apart from the S23 series, but the bezels are a fraction narrower than last year and that



means Samsung squeezes in larger screens (by 0.1in). You still get an IP68 rating and Gorilla Glass Victus 2.

AMOLED as always

Aside from being a fraction larger, the S24 series now goes brighter. Samsung claims they can reach 2,600cd/m², but we couldn't confirm this for ourselves. In our tests, the S24 hit 1,416cd/m² at peak and the S24+ managed 1,396cd/m², which are roughly 50cd/m² higher than the previous generation. I still had to keep the display brightness slider rather high to see screen details under less favourable lighting conditions, but at least the S24 has that capability.

The S24 and S24+ recreate more colours than the iPhone 15's display, but you'll struggle to notice. All of



ABOVE The S24 (left) may be smaller, but it's better value than the plus-sized version

these screens are excellent, with superb colour accuracy, so whether you're watching films or viewing photos you'll be happy.

Camera, no action

In terms of camera hardware, Samsung hasn't touched a thing for this Galaxy S24 update. The 50MP main camera, 12MP ultrawide shooter and 10MP telephoto lens with 3x optical zoom are exactly what you'd find on the Galaxy S23.

As a result, the iPhone 15 (see issue 351, p62) nudges ahead. Its results are simply more consistent, especially at night, and as always its colours feel more

balanced than Samsung's. But the S24 and S24+ win out for zooming.

And when it comes to on-phone editing, the S24 family has Galaxy AI to call upon. Editing tools take two forms: suggestions and generative edits. To use editing suggestions, open the Gallery app, select the photo you want to tweak and tap the Details icon. If Galaxy AI detects that there are improvements to be made, it will list proposed edits that you tap to accept. Common suggestions include removing shadows and adding a background blur. Sometimes it works brilliantly, but not always.

Generative edits will be familiar to anyone who's used the Magic Editor feature on the Pixel 8 (see issue 351, p72). Here, you can move around and resize objects, and generative AI is put to work fixing the background so that everything looks natural in the end. Photos altered with generative AI get a watermark, plus a designation in the new image's metadata.

My best generative edits came when I used the feature to remove objects, but my favourite AI feature is the ability to turn videos you've shot with the Galaxy into slow-motion videos. You don't have to fiddle around with slow-motion settings when capturing video: just get your footage and adjust after the fact.

Need for speed

After using the same system-on-chip for every Galaxy S23 model, Samsung has gone back to splitting up which phone gets which silicon based on region with the Galaxy S24. Phones sold in North America run on the same

GEEKBENCH 6 (MULTICORE)

Samsung S24 Ultra	7,249
Snapdragon 8 Gen 3, 12GB	
Samsung S24+	7,083
Snapdragon 8 Gen 3, 12GB	
Samsung S24	6,922
Snapdragon 8 Gen 3, 8GB	
Apple iPhone 15	6,179
Apple A16 Bionic, 6GB	
Samsung S23	4,972
Snapdragon 8 Gen 2, 8GB	

HIGHER IS BETTER

GEEKBENCH 6 (SINGLE CORE)

Apple iPhone 15	2,518
Apple A16 Bionic, 6GB	
Samsung S24 Ultra	2,300
Snapdragon 8 Gen 3, 12GB	
Samsung S24+	2,272
Snapdragon 8 Gen 3, 12GB	
Samsung S24	2,235
Snapdragon 8 Gen 3, 8GB	
Samsung S23	1,881
Snapdragon 8 Gen 2, 8GB	

HIGHER IS BETTER

3DMARK WILD LIFE EXTREME

Samsung S23	33fps
Snapdragon 8 Gen 2, 8GB	
Samsung S24 Ultra	30fps
Snapdragon 8 Gen 3, 12GB	
Samsung S24	30fps
Snapdragon 8 Gen 3, 12GB	
Samsung S24+	29fps
Snapdragon 8 Gen 3, 8GB	
Apple iPhone 15	18fps
Apple A16 Bionic, 6GB	

HIGHER IS BETTER

BATTERY LIFE

Samsung S24 Ultra	16hrs 46mins
Snapdragon 8 Gen 3, 12GB	
Samsung S24+	16hrs 32mins
Snapdragon 8 Gen 3, 12GB	
Samsung S24	13hrs 28mins
Snapdragon 8 Gen 3, 8GB	
Apple iPhone 15	11hrs 5mins
Apple A16 Bionic, 6GB	
Samsung S23	10hrs 27mins
Snapdragon 8 Gen 2, 8GB	

HIGHER IS BETTER

Snapdragon 8 Gen 3 chipset found in all Galaxy S24 Ultra models. In the UK, Samsung uses the Exynos 2400 in the Galaxy S24 and S24+.

We still await test units with the Exynos chip inside, but all signs so far indicate that they are on a par with the Snapdragon silicon. And that's a relief, because our test units produced a stellar set of scores, as shown in the graphs opposite. The Galaxy S24 Ultra outperforms its siblings in benchmarks, but good luck spotting that in practice. Likewise detecting that the 12GB of RAM in the S24+ gives it a slight edge over the 8GB in the S24.

More pertinently, the S24+ offers a 512GB option (£999) whereas the S24 tops out at 256GB. As ever, there's no microSD card slot here.

The bigger brother also has the clear edge in battery life, reaching 16hrs 32mins in our rundown tests compared to 13hrs 28mins for the S24. Both results are a big improvement over last year's models, with the S23+ lasting for 11hrs 24mins and the S23 for a mere 10hrs 27mins.

Samsung makes no change to the charging speed of these devices, which remains at 25W wired for the S24. After 30 minutes of charging, it reached a 54% charge, which isn't bad but nowhere close to the OnePlus 12; that phone's 80W charging speeds means you can get a fully charged device in just half an hour. At least the S24+ supports 45W wired charging, which took our test unit to 72% after half an hour. Both phones support 15W wireless charging.

The AI difference

I won't repeat all the Galaxy AI features, as we covered those extensively in last month's review of the S24 Ultra. Instead, I'll share my key impressions of each of the features, starting with the most intriguing: Live Translate. This promises real-time translations for 13 different languages when you're on a phone call with someone speaking in a different tongue.

It's impressive on paper but awkward in practice, as I found when I called my wife, who can speak German. Live Translate's translations weren't always accurate, perhaps because she

isn't a native German speaker but more likely because Live Translate seems to falter with casual conversation tones. The delay between someone speaking and the translated speech appearing on your phone screen or in your ear is also something that takes a little getting used to.

I'm far more impressed with what Galaxy AI brings to the Notes app. It can auto-format the notes you quickly jot down into something that's not only easier to read, but also pleasing to the eye. I was especially delighted to see that you get multiple options for notes formatting, so you can pick the one that looks the best to your eye or needs. For example, I took some quick notes on all the things that I had to do for the coming week and Note turned it into a bulleted list.

The app's auto-summary feature produced a very accurate synopsis that boiled down what I had to do on each given day.

Circle to Search works in any app, and while it's at its best in photos I've found that circling text produces results, too. It's geared too much to e-commerce for my taste – the first search results you get are usually invitations to buy what you've circled – but this is still a powerful use of AI.



LEFT The Galaxy AI features include Chat Assist to help you craft your messages



ABOVE The S24 series of phones have brighter screens than their predecessors

Decision time

Aside from AI, little has changed on the software front. But there is one big change to support, with seven years of cover for Android and security. Your S24 or S24+ will still be getting Android updates until 2031 if you hold on to the device for that long.

While the AI features are welcome additions, they're only part of what makes the Galaxy S24 and S24+ so impressive. It's the brighter screen,

longer-lasting battery and stellar performance that make these devices well worth getting, with Galaxy AI a nice add-on.

I don't think anyone with last year's Galaxy flagship needs to concern themselves with upgrading, and perhaps even Galaxy S22 users can squeeze one more year out of their device (though the better battery life would be a great leap forward from that two-year-old phone). Anyone with an older Galaxy flagship should run, not walk, to their nearest retailer, though, to grab this new model.

If the Galaxy S24 had performed a shade or two better against the iPhone 15, I would have declared this model as the entry-level flagship phone to get. As it stands, this is still one of the best base model Galaxy S phones I've ever used, delivering a lot of value for £799. At £999, however, it's harder to get so excited about the value offered by the S24+. After all, the 256GB S24 Ultra costs £1,249, and if you're spending a grand why not get the best S24 around? **PHILIP MICHAELS**

SPECIFICATIONS

Shared: 10-core Exynos 2400 SoC • Xclipse 940 graphics • 5G • triple 50MP/10MP/12MP rear cameras • 12MP front camera • Wi-Fi 7 • Bluetooth 5.3 • NFC • USB-C 3.2 Gen 2 • Android 14 with One UI 6.1 • 1yr warranty

S24: 8GB RAM • 6.2in 120Hz AMOLED screen, 1,080 x 2,340 resolution • 128GB/256GB storage • 4,000mAh battery • 71x7.6x147mm (WDH) • 167g

S24+: 12GB RAM • 6.7in 120Hz AMOLED screen, 1,440 x 3,340 resolution • 256GB/512GB storage • 4,900mAh battery • 76x7.7x159mm (WDH) • 196g





OnePlus 12R

Effectively the OnePlus 11 with a better display, bigger battery, simpler camera and lower starting price

SCORE ★★★★★

PRICE £541 (£649 inc VAT)
from [oneplus.com](https://www.oneplus.com)

Last month we were impressed by the OnePlus 12 (see issue 354, p60), the latest flagship from the Shenzhen-based manufacturer. Now, OnePlus follows up with the 12R, a more affordable variation on the theme.

At a glance, you'd be forgiven for mistaking the 12R for the full-fat edition, thanks to its rounded edges and the distinctive circular camera surround. The Iron Grey finish has a matte glass back that repels fingerprints and curves elegantly into the thin metal frame.

Along the bottom you'll find the USB-C port, SIM tray and speaker grille, while the top edge sports additional speakers and an IR transmitter. That last unusual inclusion, also found on the OnePlus 12, means you can use the phone to control a TV and some smart lights.

The most visible difference between this and the 12 is that the physical alert slider has swapped sides (OnePlus says this improves antenna performance). The whole assembly is also thinner and a touch lighter than the standard 12, in part because the 12R doesn't support wireless charging. Its simpler build also offers only IP64 dust and water resistance, so don't dunk it in the bath.

On the plus side, a Gorilla Glass Victus 2 screen coating protects against accidental drops, and the display beneath it is quite glorious. It's a 6.8in AMOLED panel, with the same peak brightness as the OnePlus 12 – a huge 4,500cd/m² for HDR content and a high-brightness mode peak of 1,600cd/m². Dolby Vision, HDR Vivid and HDR10+ support ensure everything looks bold and bright, even in the strongest sunlight.

It's a fast screen, too, dynamically scaling from 1Hz to 120Hz to offer fluidity when needed and save power the rest of the time. A 1,000Hz touch response rate outshines



specialist gaming phones, while OnePlus' "Aqua Touch" algorithm can discern between water droplets and real touch inputs, making the phone easier to use in the rain.

The preinstalled OxygenOS software is based on Android 14, with enhancements such as user-generated wallpapers. Gestures and floating windows add flexibility when multitasking, and being able to quick-launch apps from the fingerprint sensor is nice too. I'm not so sure about the Shelf – a swipe-down home for widgets – but overall OxygenOS finds a good balance between simplicity and functionality. OnePlus promises three years of OS upgrades and four years of security updates, which is good for a mid-priced phone.

There's plenty of power to see you through those years, too. The Snapdragon 8 Gen 2 SoC is no longer top of the range, but it's still one of the fastest CPUs around, and it's backed up by 16GB of RAM. OnePlus's "Trinity Engine" provides extra optimisations such as throttling for heat management and battery longevity, and prioritising memory allocation for frequently used apps. As a result, the OnePlus 12R feels as fast and fluid as any current phone, at any price;

ABOVE The 6.8in AMOLED panel goes up to 4,500cd/m² for HDR content



"A Gorilla Glass Victus 2 screen coating protects against accidental drops, and the display beneath it is quite glorious"

Genshin Impact ran perfectly at 60fps with default graphics settings.

This speedy silicon is powered by a whopping 5,500mAh battery. I measured around eight hours of screen-on time per charge, equivalent to two days of light-to-average use – up there with the best Android phones. It also supports 100W fast charging, which got me from zero to full charge in 30 minutes. The company claims the battery will last for four years or 1,600 charge cycles before capacity drops to 80% – not bad, compared to the iPhone's promise of only 500 cycles.

The biggest compromise with the OnePlus 12R is the camera. In place of the OnePlus 12's Hasselblad-branded system, the 12R uses the same Sony IMX890 main sensor as last year's OnePlus 11, along with an 8MP ultrawide and a 2MP macro camera.

The main sensor can produce great photos, snapping 12.6MP JPEG stills with excellent colour, detail and dynamic range, helped along by optical image stabilisation. It can also capture full-sensor 50MP images, as well as HDR shots in RAW. However, the ultrawide sensor can't match the detail of the main camera, and the low-res macro camera is visibly short on dynamic range and colour depth. Nor does the 12R offer AI-enhanced shooting or editing features.

If you're looking for a better camera, the regular OnePlus 12 is still good value at £899, and includes wireless charging and waterproofing. However, the OnePlus 12R ticks many high-end boxes, including a roomy 256GB of storage, for a price that's far below premium offerings from Apple, Google and Samsung. In many ways it's an upgraded version of last year's 256GB OnePlus

11 for £150 less, and a much better phone than similarly priced rivals.

ALEX WALKER-TODD

SPECIFICATIONS

8-core (3.2GHz/2.8GHz/1.8GHz) Qualcomm Snapdragon 8 Gen 2 SoC • 16GB RAM • Adreno 740 graphics • 6.8in 120Hz AMOLED screen, 1,264 x 2,780 resolution • 5G • 256GB storage • triple 50MP/8MP/2MP rear cameras • 16MP front camera • Wi-Fi 7 • Bluetooth 5.3 • NFC • 5,500mAh battery • USB-C 2 connector • Android 14 with OxygenOS 14 • 75x 8.8x 163mm (WDH) • 207g • 1yr warranty

LEFT The OnePlus 12R is slightly slimmer than the full-fat OnePlus 12

LaCie Rugged Mini

It's fast over USB-C 3.2 Gen2x2, but the asking price is simply too high

SCORE 

PRICE 2TB, £249 (£299 inc VAT)
from uk.insight.com

LaCie has many similar-looking external drives, but if you're looking for the new, compact Rugged Mini – announced at CES 2024 – then ensure you buy one with a code that starts with STMF. For instance, the 2TB model reviewed here is the STMF2000400. It's pocketable, supports 20Mbit/sec USB-C 3.2 Gen 2x2 mode and is IP54-rated for water and dust protection.

The bold orange rubberised bumper both looks distinctive and gives extra protection: LaCie claims it can survive a 1m drop (on the box and in the brochure; the website states 3m) and one tonne of



car-crushing resistance. You can remove the bumper, which makes it both slimmer and easier to see the recessed activity LED, but doing so sacrifices the IP54 rating.

There's no extra protective pouch in the box, merely the drive and a 20cm USB-C cable, which is stingy for the price. The only bonus is LaCie's Toolkit software, which enables folders to be automatically synced to the drive. It's the same basic tool that Seagate (which owns LaCie) provides with many of its drives, and can either back up standard Windows folders or your own selection.

Performance depends on the connection. Over USB 3.2 Gen 2x2, CrystalDiskMark 8 recorded reading speeds of 2,049MB/sec and writing at 1,843MB/sec. Fine speeds, and even in the AJA System test in 64GB file mode its performance stayed solid, suggesting the drive's cache is big enough to write large files without choking. However, as soon as I moved away from USB-C 3.2 Gen 2x2 – say to



ABOVE The orange bumper gives the SSD an IP54 rating

Thunderbolt, where it switches to USB compatibility mode, or USB-C 3.2 Gen 2 – speed roughly halved.

The bigger problem for LaCie is that the Crucial X10 Pro (which also supports Gen 2x2) matched the LaCie in all tests while being much cheaper. Its 2TB edition costs £179 inc VAT direct from Crucial while the 4TB version costs £283, so £16 cheaper than the 2TB Rugged Mini. It has a five-year warranty, too, not three years as supplied by LaCie, and supports hardware encryption. It's also smaller, lighter and includes IP55 water and dust resistance.

The truth is that most people won't have USB-C 3.2 Gen 2x2 ports, so you might as well save your money and buy the Crucial X9 Pro for even less. For instance, the 2TB model

costs £150 from Amazon. Unless the retail price of the Rugged Mini drops substantially, this is a good-looking device but one for LaCie devotees only. **MARK PICKAVANCE**

"The problem for LaCie is that the Crucial X10 Pro matched the LaCie in all tests while being much cheaper"

LEFT Performance over a USB 3.2 Gen 2x2 connection is speedy

SPECIFICATIONS

1TB/2TB/4TB PCI-E SSD • USB-C 3.2 Gen 2x2 interface • up to 2,000MB/sec sequential read and write • 105 x 17.3 x 67mm (WDH) • 114g • 3yr limited warranty • part code STMF2000400

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Norton 360 Premium for £19.99

(10 devices for two years)

pcpro.link/norton360

Norton is one of the most trusted security brands around, and rightly so: it consistently earns 100% protection ratings from both AV-Comparatives and AV-Test. Norton 360 Premium is a comprehensive selection of tools designed to give you security and peace of mind.

First up is Norton Security, which offers strong anti-malware protection to monitor files and programs – not just for known threats, but for suspicious behaviour, too. This helps block malware before it can gain a foothold on your system. You also get a firewall, silently blocking attacks from both outside and inside your PC. Web Safety components check the links you click to make sure they're safe to visit, while downloaded files are screened and checked for both security and reliability.

Norton 360 bundles Secure VPN, which lets you browse anonymously wherever you are, block ad trackers and get "bank-grade encryption". You can

use your VPN to locate yourself in another country, which is good for watching TV while abroad, or simply to create a secure tunnel to the internet to stop hackers finding your real location and IP address.

Dark Web Monitoring will keep an eye on your data, such as email addresses and passwords, then check to see if this has been compromised online. If it has, it will warn you and you can quickly update your passwords.

Then there's a whopping 75GB of cloud storage for backups, plus Norton Parental Control so you see exactly what your children are up to on their various devices. You also get GPS location monitoring for Android and iOS and content filtering for PCs.

Finally, Norton Password Manager generates and stores passwords across all your devices, while SafeCam for PC stops cybercriminals attempting to take photos with your webcam with you knowing.



ALSO CONSIDER Avast Ultimate Suite 2024 (10 devices/2yrs) for £29.99 SAVE 85%

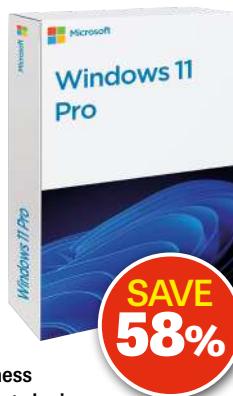
Upgrade to Windows 11 Pro for just £49.99

tinyurl.com/pcprowin11

If you're using Windows 11 Home but fancy switching to Professional, we have great news. Not only is it a steal at £49.99, but it's incredibly simple to do. Upgrading is a matter of typing "Change product key" and then entering your new Pro licence key into the dialog box. Windows will then update and reboot, and you'll see a fully activated Windows 11 Pro.

Within minutes, you'll have access to extra business functionality: enhanced BitLocker encryption, remote logins and more. Perhaps best of all, you can create and host virtual machines using Hyper-V, which is ideal for testing new software or, if you're a developer, checking how your software performs on other OSes.

Windows 11 Pro also enables you to quickly connect to a domain – this could be your business or a school – to access network files, servers and printers. It's ideal for taking your work on the road when you still need access to the office network.



ALSO CONSIDER Windows 10 Home (full, OEM) SAVE 58%

Acronis Cyber Protect Home Office 2023 Advanced for £29.99

(1 device, 1 year, 50GB storage)

tinyurl.com/pcprocyber

Acronis Cyber Protect has one simple aim: to protect your data from any threat. That means you get backup, disk cloning, cyber protection and privacy tools in a single package.

Advanced backup and disk cloning sit at this product's core. You get flexible backups, from full drive images to individual files, and clever incremental and differential options encourage daily backups without filling your storage. You also receive active disk cloning for migrating to faster or bigger hard drives. Perhaps most reassuringly, you benefit from Acronis' unique ransomware protection, too.

The Advanced version packs in a whole heap of extra features, including antivirus and anti-malware to protect your computer and your backups.

The £29.99 price, a 23% saving over the full £38.99 cost, includes a one-device licence for either a PC or Mac with a one-year subscription and 50GB of cloud storage.



ALSO CONSIDER Auslogics File Recovery for £12.95 SAVE 35%

Motorola Moto G54 5G

A dramatic improvement on the G53, with a superb display, attractive design and strong battery life

SCORE

PRICE 256GB, £150 (£180 inc VAT)
from johnlewis.com

Motorola's Moto G54 5G continues the company's mission to offer high-quality phones for as low a price as possible. In this case £180 inc VAT – £10 less than the previous model. And that's with 256GB of storage, too.

While the phone isn't exactly a fashion statement, it's still attractive. I tested the Indigo Blue colour, which has a vegan leather back that's both pleasing on the eye and to hold. You can also choose from Glacier Blue, Midnight Blue and Mint Green finishes, although those have all-plastic bodies. In all cases, the camera bump on the rear barely protrudes at all, so when the phone is set down on a surface it sits flat.

The front is dominated by a 6.5in screen with a small punch hole camera in the top centre. A power button (with built-in fingerprint sensor) and volume rocker sit on the right edge, while the left edge offers the SIM and microSD card tray, the latter accepting cards up to 1TB. The Moto G54 5G also supports eSIMs, or a combination of physical and virtual modules.

I do have a few gripes with the design. While the overall arrangement

of buttons works well, it's a tall case, and I found the placement of the volume rocker was too high to use comfortably. As with the Moto G53, there's also no Gorilla Glass protection for the screen, and the housing is advertised merely as "water-repellent", so take care not to bash or splash it too much.

On the plus side, the screen gets a huge upgrade from last year's model. The IPS panel has an auto-adjusting refresh rate of up to 120Hz and a sharp native resolution of 1,080 x 2,400, equivalent to 405ppi – almost double the detail of the G53. Colours are noticeably more vibrant, too, with contrast not far off OLED levels; when watching videos, I could barely see a difference between this display and my iPhone 13 Pro. Dolby Atmos processing enhances audio, too: the virtual surround-sound effect was

striking on Netflix, with an impressive sense of space and direction. My only reservation is that the glass front of the phone is quite reflective, so for the best cinematic experience find a position away from bright light sources.

Motorola has stuck with the same dual-camera arrangement as the G53, namely a 50MP main sensor and a 2MP macro unit. It has, however, added optical image stabilisation, which means sharper images by day and enhanced detail in low light. The test snaps I took with the G54 definitely looked better than those from the previous model, with natural colours and only minimal noise when I digitally zoomed in. They're not as rich or crisp



ABOVE The tall 6.5in screen has vibrant colours and excellent contrast levels



LEFT The 50MP main camera and 2MP macro sensor barely protrude from the back

"The Moto G54 5G improves on the previous generation in numerous ways while being somehow even cheaper"

BELLOW The Moto G54 5G is available in four striking finishes



as the images from pricier phones, though, and I turned off the Auto Enhance feature as it made images look airbrushed. I didn't love the front camera, either; while the resolution has doubled from 8MP to 16MP, selfies came out looking stark and unflattering. I won't be sharing them on social media.

The G54 5G uses a MediaTek Dimensity 7020 processor, yet another step up from the Snapdragon 480+ chip found in the G53. The RAM has been doubled, from 4GB to a much more comfortable 8GB, resulting in smoother performance all round. In Geekbench 6, the Moto G54 5G achieved a

single-core score of 924 and a multicore result of 2,354, substantially up from the G53's 719 and 1,743 totals.

The new Moto isn't bad at gaming, either: I played Asphalt 9 with no discernible lag or frame rate drops. I did notice heat building through the rear panel, though, suggesting that intense and extensive gaming sessions may be out of the question.

One area where Moto phones have always done well is battery life, and I'm pleased to say that doesn't change here. Typically, the 5,000mAh battery lasted comfortably into a second day of casual use. Streaming video or gaming will run it down faster, but Motorola mitigates that with an

improved charging speed; the Moto G54 5G now comes with a 20W charger in the box, which got me from 18% to 100% in roughly an hour and a half. Wireless charging isn't supported – a shame, but hardly a surprise.

The Moto G54 5G is an impressive phone for the price. The display is its standout feature, but the phone also improves on the previous generation in numerous ways while being somehow even cheaper. Naturally the camera hardware isn't up there with the best in the business, but as an everyday phone there's little here to complain about; you won't do better for less than £200. **MAX LANGRIDGE**

SPECIFICATIONS

8-core 2.2GHz/2GHz MediaTek Dimensity 7020 SoC • 8GB RAM • IMG BXM-8-256 graphics • 6.5in 120Hz IPS screen, 1,080 x 2,400 resolution • 256GB storage • microSD card slot • water-repellent • dual 50MP/2MP rear cameras • 16MP selfie camera • 5G • Wi-Fi 5 • Bluetooth 5.3 • USB-C 2 connector • 5,000mAh battery • Android 13 • 74x8x162mm (WDH) • 177g • 1yr RTB warranty





SECURITY SUITES VS FREE ANTIVIRUS

We investigate 11 alternatives to Windows Defender – and round up the freebies – to reveal what's worth paying for

Here's the basic question this Labs aims to answer: is it worth spending money on a security suite when Windows Defender does the job for free?

Our answer: yes, probably. At the very least, you should consider one of the free alternatives. Turn to p89 for more on that topic.

However, there isn't a straightforward answer that's right for everyone. Some people might find it simpler to stick with Windows as it does the job, even if it can't match the top anti-malware for protection levels. Some may find the upgrade nags in the free alternatives unbearably annoying.

It's also well worth dipping into your pocket for the right product and the right reasons. It can provide an affordable route

to VPNs, which could be extremely useful for those times when you're abroad or want an extra layer of protection. Not to forget the threat of ransomware:

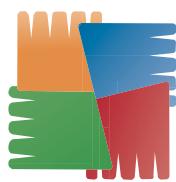
most paid-for security suites offer extra tools that guard you against such attacks. We detail the kinds of features to look for in our buyer's guide on p82 and in the individual reviews.

One final word of warning, however. Often, buying direct from the suppliers will result in automatic renewals at a higher rate after your initial year. In general, we recommend buying from an online retailer where prices are more aggressive and – most of the time – you won't be hooked into a renewal.

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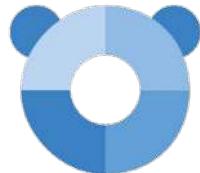
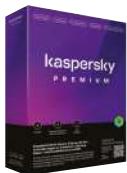
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CONTRIBUTOR:
KG Orphanides



	LABS WINNER	RECOMMENDED		RECOMMENDED		RECOMMENDED
	Avast Ultimate	AVG Ultimate	Avira Prime	Bitdefender Total Security	Eset Home Security Ultimate	G Data Total Security
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Website	avast.com	avg.com	avira.com	bitdefender.co.uk	eset.com	gdatasoftware.co.uk
Desktop clients	Windows, macOS	Windows, macOS	Windows, macOS	Windows, macOS	Windows, macOS	Windows, macOS
Mobile clients	Android, iOS	Android, iOS	Android, iOS	Android, iOS	Android	Android, iOS
Pricing						
First year's price direct	1PC, £35 (£42 inc VAT), 10 devices, £54 (£65 inc VAT)	10 devices, £67 (£80 inc VAT)	5 devices, £43 (£52 inc VAT)	5 devices, £42 (£50 inc VAT)	5 devices, £96 (£115 inc VAT)	1 device, \$50; 3 devices, \$66; 5 devices, \$82
Renewal price (1yr)	1PC, £75 (£90 inc VAT); 10 devices, £92 (£110 inc VAT)	10 devices, £92 (£110 inc VAT)	5 devices, £76 (£91 inc VAT)	5 devices, £63 (£75 inc VAT)	5 devices, £96 (£115 inc VAT)	1 device, \$50; 3 devices, \$66; 5 devices, \$82
Best third-party retail price	10 devices, 2yrs, £25 (£30 inc VAT) from store.pcpro.co.uk	10 devices, 2yrs, £25 (£30 inc VAT) from store.pcpro.co.uk	Not available ¹	5 devices, 1yr, £25 (£30 inc VAT) from store.pcpro.co.uk	Not available ²	✗
Features						
Firewall	✓	✓	✓	✓	✓	✓
Browser protection	✓	✓	✓	✓	✓	✓
Ransomware protection	✓	✓	✗	✓	✗	✓
Cloud backup	✗	✗	✗	✗	✗	✗ ³
Webcam protection	✗	✗	✗	✓	✓	✗
VPN	✓	✓	✓	✓	✓	✗
Password manager	✗	✗	✓	✗	✓	✓
Scheduled scans?	✓	✓	✓	✓	✓	✓
Silent detection mode	✓	✓	✗	✓	✓	✓
Parental controls	✗	✗	✗	✓	✓	✓
Device management/tracking	✓ (mobile only)	✓ (mobile only)	✗	✓	✓	✗
Bootable rescue disk	✗	✗	✓ (free download)	✗	✓ (free download)	✓ (within client)
Breach monitoring	✓	✓	✓	✗	✗	✗
Data broker removal service	✗	✗	✗	✗	✗	✗
Identity theft/lost wallet support	✗	✗	✗	✗	✗	✗
Test results						
AV-Test Real-world (batch 1)	100%	100%	99.2%	100%	N/A	N/A
AV-Test Real-world (batch 2)	100%	100%	100%	100%	N/A	N/A
AV-Test Reference (batch 1)	100%	100%	100%	100%	N/A	N/A
AV-Test Reference (batch 2)	100%	100%	100%	100%	N/A	N/A
AV-Test false positives (total)	0	0	0	2	N/A	N/A
AV-Test protection score	6	6	6	6	N/A	N/A
AV-Test performance score	6	5.5	6	6	N/A	N/A
AV-Test usability score	6	6	6	6	N/A	N/A
AV Comparatives Real-World Protection – % blocked	100%	100%	99.4%	99.6%	98.2%	99.6%
AV Comparatives Real-World Protection – false positives	2	2	6	3	0	8
SE Labs Protection rating	100%	N/A	N/A	N/A	N/A	N/A
SE Labs Legitimate Accuracy	100%	N/A	N/A	N/A	N/A	N/A
SE Labs Total Accuracy rating	100%	N/A	N/A	N/A	N/A	N/A

¹Avira Internet Security, 3 devices, is £30 inc VAT from amazon.co.uk. ²Eset Home Security Premium, 5 devices, is £65 inc VAT from amazon.co.uk. ³Total Protection, 10 devices, yr, £20 inc VAT from amazon.co.uk. ⁴Supplied via separate software.



RECOMMENDED					
Kaspersky Premium	McAfee+ Advanced	Microsoft Defender Antivirus	Norton 360 Premium	Panda Dome Security Suite Premium	Trend Micro Maximum Security
5 devices, 5 stars	5 devices, 5 stars	5 devices, 5 stars	5 devices, 5 stars	5 devices, 5 stars	5 devices, 5 stars
kaspersky.co.uk	mcafee.com	microsoft.com	uk.norton.com	pandasecurity.com	trendmicro.com
Windows, macOS	Windows, macOS	Windows, macOS	Windows, macOS	Windows	Windows, macOS, ChromeOS
Android, iOS	Android, iOS	x	Android	Android	Android, iOS

5 devices, £19 (£23 inc VAT)	Individual, unlimited devices, £63 (£75 inc VAT); family, unlimited devices, £96 (£115 inc VAT)	Free	Plus, 1 device, £17 (£20 inc VAT); Standard, 1 device, £21 (£25 inc VAT); Deluxe, 5 devices, £25 (£30 inc VAT); Advanced, 10 devices, £29 (£35 inc VAT)	5 devices, £33 (£40 inc VAT); unlimited devices, £42 (£50 inc VAT)	3 devices, £21 (£25 inc VAT); 5 devices, £25 (£30 inc VAT); 10 devices, £29 (£35 inc VAT)
5 devices, £48 (£58 inc VAT)	Individual, unlimited devices, £133 (£160 inc VAT); family, unlimited devices, £192 (£230 inc VAT)	Free	Plus, 1 device, £29 (£35 inc VAT); Standard, 1 device, £54 (£65 inc VAT); Deluxe, 5 devices, £74 (£89 inc VAT); Advanced, 10 devices, £125 (£150 inc VAT)	5 devices, £33 (£40 inc VAT); unlimited devices, £42 (£50 inc VAT)	3 devices, £58 (£70 inc VAT); 5 devices, £67 (£80 inc VAT); 10 devices, £88 (£105 inc VAT)
5 devices, 1yr; £14 (£17 inc VAT) from amazon.co.uk	Not available ³	x	10 devices, 2yrs, £17 (£20 inc VAT) from store.pcpro.co.uk	x	3 devices, 1yr, £17 (£20 inc VAT) from amazon.co.uk

✓	✓	✓	✓	x	Booster
✓	✓	✓	✓	x	✓
✓	✓	✓	Cloud backup service	x	✓
x	x	5GB (OneDrive)	10GB – 200GB depending on sub	x	x
✓	✓	x	✓	x	x
✓ (300MB daily cap)	✓	x	✓	✓	x
✓	✓	x	✓	x	✓
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓
✓ ⁵	✓ (Family plans only)	✓	✓ (Deluxe and above)	x	✓
✓	✓	✓	✓	✓ (Android only)	✓
✓ (free download)	x	x	✓ (free download)	✓ (within client)	✓ (free download)
✓	✓	x	✓	x	x
x	✓	x	x	x	x
x	✓	x	✓	x	x

100%	100%	100%	100%	N/A	100%
99.2%	100%	99.2%	100%	N/A	99.2%
100%	100%	100%	100%	N/A	100%
100%	100%	100%	100%	N/A	100%
0	2	0	0	N/A	0
6	6	6	6	N/A	6
6	6	5.5	5.5	N/A	6
6	6	6	6	N/A	6
99.6%	99.6%	98.8%	98.8%	98.6%	100%
2	6	3	17	20	35
100%	96%	100%	100%	97%	N/A
100%	100%	100%	100%	100%	N/A
100%	99%	100%	100%	99%	N/A

How to choose the right security suite

Navigating the various choices of security suite, from free to options costing over £200, can seem impossible. This guide will point you in the right direction

Modern security software packs in loads of features, but make no mistake: not getting infected by malware should be your top priority.

That means real-time malware protection is the critical feature of a security suite. This is a service that continuously monitors your PC for malicious software, primarily by scanning new files and websites your computer encounters.

It's also our minimum bar for inclusion in this group test. For example, the free edition of Malwarebytes is effective and justifiably popular but, unlike its paid-for version, it only provides on-demand scanning.

Every single product in this group test will protect your computer against the vast majority of malicious software. Performance analysis of malware protection is in the business of assessing edge cases, unfamiliar malware and false positives. These marginal instances can have an impact on your quality of life and, potentially, the health of your PC.

■ What anti-malware protection looks for

Malware signatures – the hashes of known malicious files – remain important to both real-time and on-demand scanning, and this is why you still see testing houses running flat file scans against large batches of recently collected malware introduced on a disk.

But polymorphic viruses and other forms of obfuscated malware



ABOVE Ransomware protection is a vital tool in your armoury

have been around for decades, which is where heuristic scanning comes in: this looks at characteristics and behaviours of a suspicious file or process to determine whether it's likely to be a threat.

For example, does it use known detection-evasion techniques such as encryption or compression ("packing")? Does it engage in potentially threatening behaviour such as attempting to delete files or terminate processes? Characteristics such as these allow antivirus software to decide whether an unknown program is likely to be a threat or not.

■ Can it beat Microsoft Defender?

The fundamental question about any third-party antivirus solution is whether it can consistently

perform better than Microsoft Defender Antivirus, which comes built into Windows 10 and 11, and requires no additional software installation or payment.

Although every other security suite in this group test is paid-for, we've reviewed the "for individuals" version of Microsoft Defender that comes free with Windows on the same terms as its rivals. The fact that you don't need to install anything new or update any licences makes it a compelling choice, particularly when it comes to protecting the PCs of less tech-savvy friends and relations. However, as Windows' default protection against viruses, it has to match the performance of third-party software to justify being left active.

Due to the huge number of systems it's deployed on, Microsoft has a real advantage when it comes to obtaining malware samples to analyse, which informs not only its malware signature database, but also the behaviour data it has to add to its heuristic rules of thumb for sketchy software. However, as the results show, that doesn't make it the best choice and competition is important.



LEFT Windows' built-in security tools may be sufficient for some PCs



■ Money matters

Although it's not the main focus of this group test, free antivirus is a good choice as long as you choose reputable companies whose software receives proper testing. Free AV firms benefit by getting more data about malware that their free users encounter, by promoting their paid-for products, and by the reputational boost that their free products bring.

Paid-for security suites generally include features that are more expensive to provide, from password managers and parental controls to cloud backup and even hands-on helplines in case you lose your wallet or have your identity stolen.

We've generally picked products towards the higher end of each company's range, and then tried to find the lowest price we can for each of them. In the feature table on p80 and the reviews, you'll find both the price direct from the company's website and the cheapest third-party deal. Most of the time, that either means the PC Pro shop ([store](#)) or Amazon.

As you'll see, there's a huge difference between direct prices and those from retail. The former range from £50 to over £200, while the in-store prices range from £17 to £55. And there's a hidden difference, too: most of the time, if you buy from retail you won't get hit with an auto-renewal. However, on almost every occasion if you order direct from a supplier then you'll get a "discounted" rate for the first year and a higher price for renewals.

■ Extra features

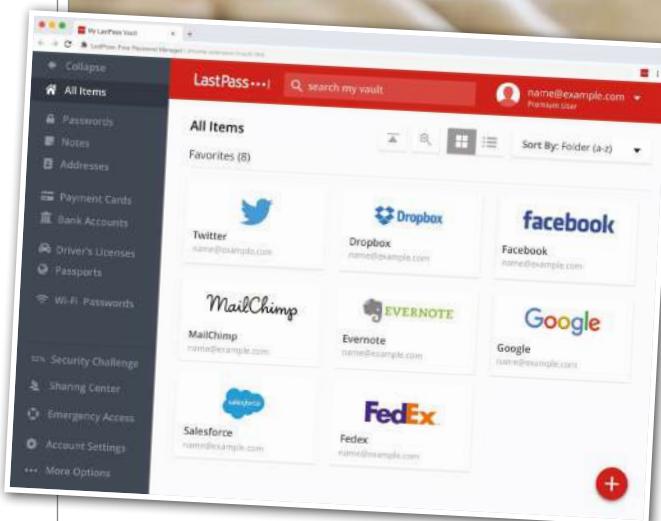
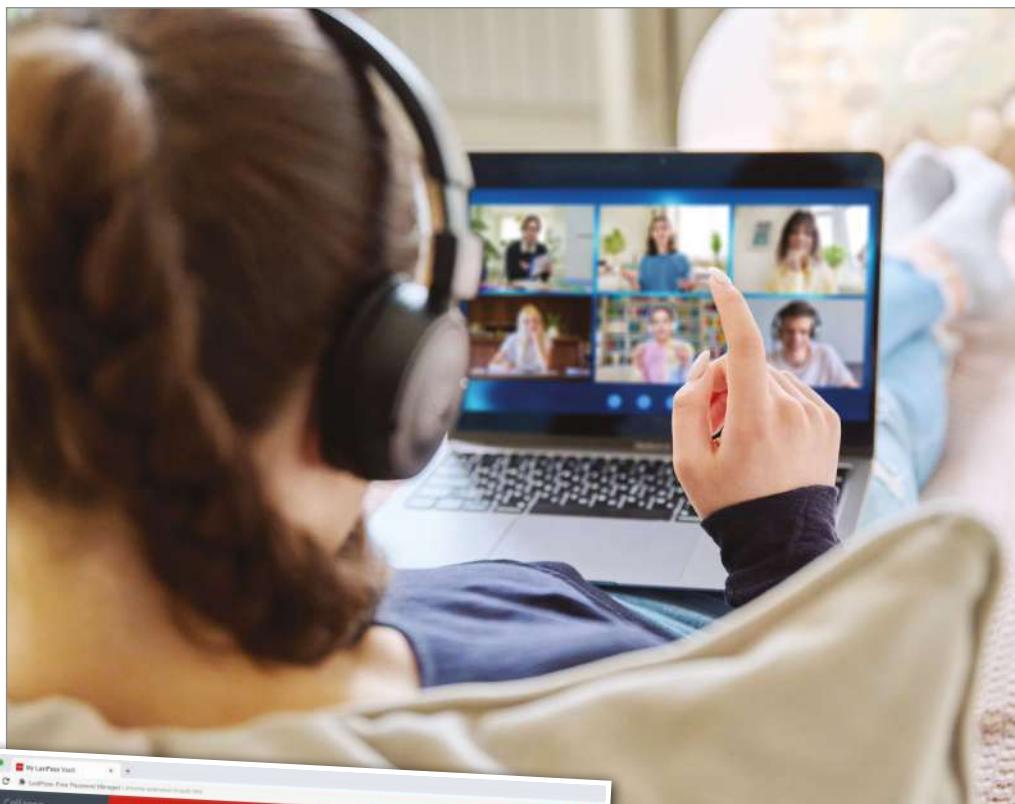
While our scores are weighted heavily towards real-time protection against malware, all the products in this group test do a lot more (other than Windows Defender), helping to justify their status as fully fledged security suites.

Some of these features specifically concern device security. We're big fans of ransomware protection that can lock down and/or back up your most important folders, for instance.

Tiered choices

Each of our reviews focuses on the named tier of a service, such as Total Security compared to Internet Security. Often, the differences between these tiers can be superficial, so check exactly what you're buying before you commit: you may well be able to save money by moving one tier down.

The one thing that doesn't change is the level of malware detection. In short, you don't need to pay extra to get better protection against malicious software.



ABOVE Beware of bundled extras such as password managers

You may also appreciate web-based management consoles that allow you to remotely find, lock down or wipe lost computers or mobile devices.

We're big fans of ransomware protection that can lock down and/or back up your most important folders

There are a bunch of extra security features, too: dedicated webcam protection, bootable rescue disks to help you recover after a malware infection, firewall software that, in almost all cases, has a less creaky interface for creating rules than Microsoft's integrated solution.

You'll also see a lot of things that you might otherwise buy as a dedicated service, such as password managers, parental control software, cloud backup services and VPNs.

While it might be convenient to get everything bundled together, these "extra" products can be a long way from best-in-class. In particular, you don't want your password manager or

ABOVE Some extras, such as dedicated webcam protection, can be worthwhile

cloud backup provider – long-term, high-security subscriptions by their nature – to be tied into a bundle with malware protection that you might decide to swap to another provider in a year's time.

If you're a power user, you probably already have opinions and requirements about many of these things. If you use multiple operating systems, or want a VPN that you can deploy to your router, the VPNs bundled with security suites rarely provide sufficient flexibility.

Bundled parental control suites tend to be mostly okay, with the caveat that they rarely offer features above and beyond what you get built into Windows (Microsoft Family Safety) or macOS (macOS Parental Controls). Their main point of difference is that they offer a cross-platform solution. However, buyer beware: some third-party parental control suites, including those provided with internet security software, are less than respectful of children's rights under British law.

The final category of extras consists of tools such as local encrypted data stores, secure file shredders, Registry cleaners, disk usage analysers and even disk defragmenters. Although these can be handy, there are free and open-source applications that do as well or better in almost all cases, so these can be safely ignored as filler.



Avast Ultimate

Avast not only provides the best paid-for suite, it also offers the best free antivirus protection around

SCORE ★★★★★

DIRECT PRICE 10 devices, £54

(£65 inc VAT) from avast.com

RETAIL PRICE 10 devices, 2yrs, £25

(£30 inc VAT) from store.pcpro.co.uk



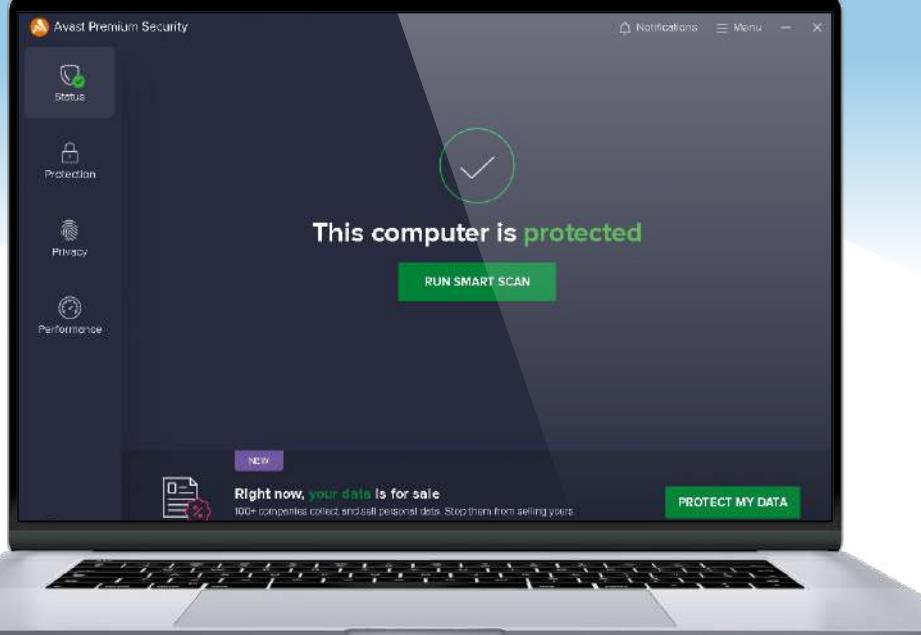
Avast's offerings need careful explanation. Avast Ultimate includes Avast Premium Security, Avast SecureLine VPN, Avast AntiTrack Premium and Avast Cleanup Premium. It's the main subject of our review here. However, if you'd rather have everything in a single application, then Avast One is also worth considering. Both use the same malware-detection engine and VPN infrastructure, so the core functionality is the same, although the two products' feature sets differ on several points.

Regardless of which version of Avast you subscribe to, you'll benefit from the same malware-detection engine. Avast's sibling AVG also uses the same detection engine, with the same effective results, although the app itself is different. This is why Avast did better in AV-Test's system performance tests.

Avast products have recently been tested by all three major testing houses whose data we use in our assessment, with 100% protection scores all round. Even more impressively, we saw only two false positives across the whole range of tests, which is an outstanding result. This puts Avast (and AVG) ahead of its rivals, including stablemates Avira and NortonLifeLock, which have their own detection engines.

Because Avast's detection prowess is available to both free and paying users, the main benefit of paying for Ultimate comes from extra features such as webcam protection, a nicer firewall interface than Windows' built-in option and a VPN (which we'll come on to).

Avast AntiTrack doesn't provide tracker or ad-blocking that's any better than you'll get from free tools such as uBlock Origin or Privacy Badger, while the Cleanup tools



should be handled with care, as any tool of this kind can be overly aggressive when it comes to Registry cleaning. This isn't an issue exclusive to Avast, but make sure you know what you're getting rid of.

Avast Premium Security's default settings are designed to protect potentially vulnerable users, but may annoy those with more sophisticated requirements. For example, on our test systems, the Remote Access Shield blocked RDP and SMB connections that we'd enabled in Windows without notice. It also has a Samba protection option which, again, can block all attempts from other users or devices on your network to connect to SMB shares that you set up on your PC. To its credit, Remote Access Shield does include an IP-address-based whitelist and is hassle-free once configured, but users with advanced networking requirements should know that they may have to spend some time setting this up.

Avast's SecureLine VPN uses its own dedicated VPN infrastructure, rather than being a white-label version of another firm's service. Historically, it's performed reliably when it comes to transfer speeds, and it supports the modern WireGuard protocol, as well as OpenVPN. It also has its own Mimic protocol, which attempts to hide the fact that you're using a VPN at all. This only works using Avast's own clients for Windows, macOS, Android and iOS, which include critical security features such as a kill switch to cut off all traffic if your VPN connection drops – although this must be manually enabled. The Android version also supports split

ABOVE Avast supplies excellent protection and a range of useful additional tools



"Avast products have been tested by all three testing houses whose data we use, with 100% protection scores all round"

tunnelling, which allows you to exclude selected apps from the VPN.

Annoyingly, although Avast Ultimate is paid-for software, there were still a couple of banner ads with scareware-style alerts stating that "Right now, your data is for sale". These led to a subscription screen for Avast BreachGuard, which isn't included in Avast Ultimate but is in Avast One. Avast Driver Updater is advertised in a similar manner.

Despite Avast One being the company's current flagship product, it lacks some features you'll find in Ultimate. These include the ability to create a rescue disk, Mail Shield integration with desktop email clients, the Remote Access Shield (probably for the best), the Sandbox

that allows you to run suspicious applications in isolation from your OS, the data shredder for secure file deletion, and some more granular firewall and do-not-disturb settings. Because of this, Avast Ultimate is a better option for those who require these features.

A ten-device subscription from Avast costs £65 inc VAT for the first year, automatically renewing at £110 thereafter. Buy the same subscription from a third-party retailer, however, and you'll pay around £30, with no sneaky renewals (the best price we could find was from store.pcpro.co.uk). You might not need everything in Avast Ultimate, but it provides very capable defence against malware, a decent VPN and a versatile array of supporting tools.

And that's why it's our top choice for antivirus.



AVG Ultimate

Superb antivirus protection and great value if you buy from retail, but it's essentially identical to Avast Ultimate

SCORE ★★★★★

DIRECT PRICE 10 devices, £67

(£80 inc VAT) from avg.com

RETAIL PRICE 10 devices, 2yrs, £25

(£30 inc VAT) from store.pcpro.co.uk



AVG Ultimate is functionally identical to Avast Ultimate. They use the same engine, have the same tools, and are basically reskinned versions of the same thing. This has been the case since shortly after Avast bought AVG in 2016. Both are now part of Gen Digital, which formed when Avast merged with NortonLifeLock in 2022. AVG's sibling companies include Avira, VPN provider HMA, and Registry cleaner maker Piriform, among others.

Like Avast, AVG got 100% protection scores from both AV-Test and AV-Comparatives, with two false positives in the latter's latest Real-World Protection Test. AVG isn't tested by SE Labs, but Avast is, and it got a perfect score, so you can extrapolate the anti-malware engine's effectiveness from that.

If you turn to the feature table on p80, you'll notice that AVG only got a 5.5 out of 6 performance score from AV-Test, compared to Avast. This is a consistent difference between the two. Dig deep into the results and you'll discover that AVG had noticeably slower website loading speeds on both low- and high-spec computers. This seems like a clear argument in favour of Avast, but there is an explanation: AV-Test actually doesn't test equivalent versions of the two software suites.

To be precise, AV-Test regularly reviews Avast Free and AVG Internet Security. These are two different products and come with two different sets of features. In performance tests that compare identical versions of the software, such as AV-Comparatives' October 2023 performance test, the two once again become indistinguishable.

The apparent cause of the difference in AV-Test's performance results is AVG's fake and malicious



website protection and anti-phishing modules. On the subject of protective tools that can have an unexpected impact on your user experience, it's worth noting that AVG shared Avast's somewhat annoying behaviour of silently blocking RDP connections.

As with Avast, then, users with advanced requirements will need to spend several rather tedious minutes in the settings changing the software's default behaviour. This is part of a general trend in antivirus software that seeks to provide protection for relatively inexperienced or non-technical users, leaving those who know what they're doing to tweak configurations as needed.

When installing AVG, you'll be offered the AVG Secure Browser, with the options of making it your default browser. Install it if you want, by all means – it's yet another Chromium variant, with some integrated extensions that tie it into AVG's services, such as the VPN – but you probably don't want it to take over as default browser. You can also select from a very granular list of modules you may or may not wish to have at install time, via the advanced installation options. That means that, for example, if you don't want to install the Remote Access Shield, you can choose not to.

AVG Ultimate includes four separate tools: the core antivirus suite, AVG Internet Security; AVG Secure VPN, a rebranded version of Avast Secure VPN, which is a generally quick and capable VPN service; AVG TuneUp; and AVG AntiTrack. The

ABOVE AVG Ultimate is essentially a reskinned version of Labs winner Avast Ultimate



latter includes a selection of Registry cleaners and anti-tracker tools, all of which can be adequately replaced by free alternatives.

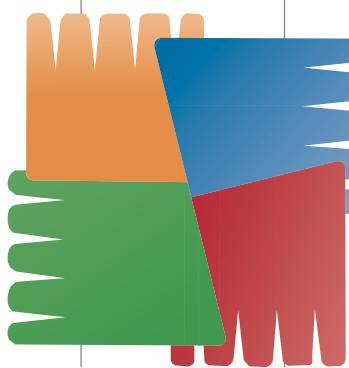
AVG Ultimate's client has a different layout to Avast Ultimate, but they share the same tools and default behaviours. That includes the usual file and online content scanning, a setting to opt selected folders into ransomware protection that monitors them for suspicious changes, network threat scanning, email scanning for desktop clients, a firewall with a more modern interface than Windows', and webcam protection.

It costs the same as Avast Ultimate, too, and is similarly expensive from the official shop, with a ten-device subscription £80 for the first year, automatically renewing at £110. There's no AVG equivalent to the Avast One all-in-one

service subscription, which at least makes upgrading less confusing.

However, as with Avast, you shouldn't be buying from the official store at all. Instead, you can pick up a third-party retail licence for £30 (this was the best price we could find, which was from PC Pro's own online store at store.pcpro.co.uk). This both costs less and avoids the risk of unpleasant auto-renewal surprises on your card statement. Plus it's for a two-year licence.

Although Avast gets our top award, if you're attached to the AVG branding or its appealing black-and-green colour scheme, then by all means use this version.





Bitdefender Total Security

Good security but a confusing range of price tiers and international options: only buy it at retail

SCORE

DIRECT PRICE 5 devices, £42 (£50 inc VAT) from bitdefender.co.uk

RETAIL PRICE 5 devices, 1yr, £25 (£30 inc VAT) from store.pcpro.co.uk



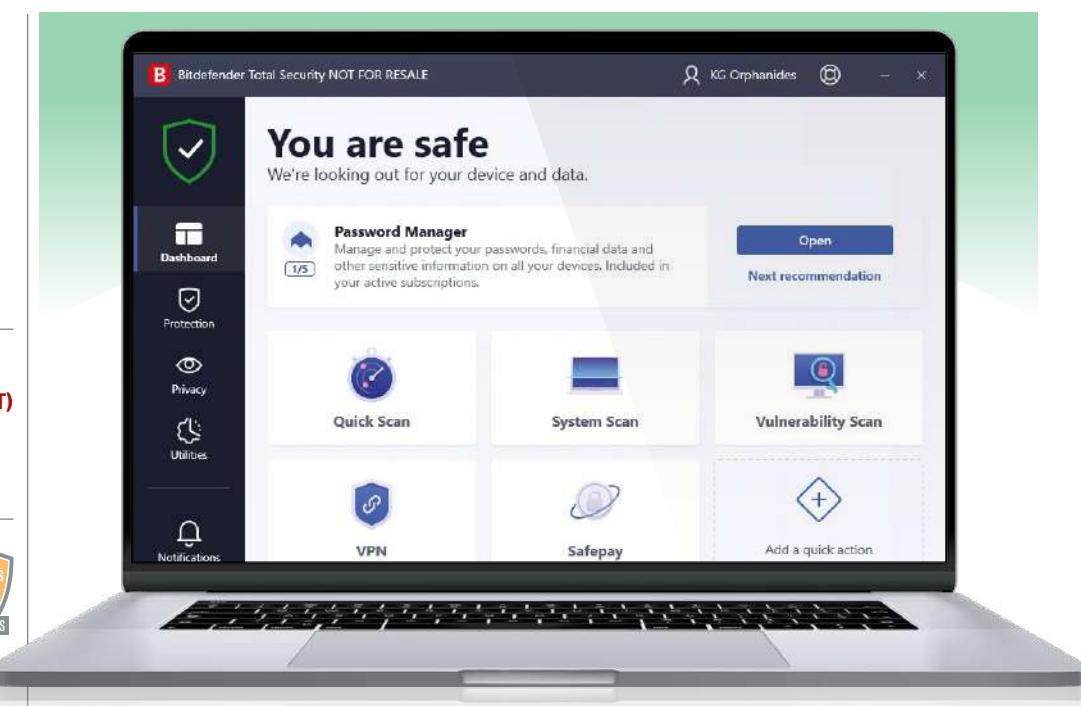
Bitdefender makes reliable, easy-to-use antivirus software that doesn't hog your system resources and doesn't bother you. This applies to all versions, from its free antivirus to the parental-control equipped Family Pack and its all-in-one Premium Security tier.

We tested Bitdefender Total Security, which is the company's top-tier device security suite, but doesn't include the parental control modules that comes with a Family Pack subscription. We found the parental controls rather invasive, so better suited to young children, but the main benefit of the Family Pack is that it covers 15 devices rather than Total's five. To confuse matters, Bitdefender also offers a Premium offering, for ten devices, but it's expensive for what it is.

All of this, combined with Ultimate identity theft protection and services that aren't available in the UK but do appear in Bitdefender Central's management dashboard, makes shopping for services on Bitdefender's site more confusing than it ought to be. However, as with most antivirus providers you're actually better off buying your Bitdefender subscription codes from third-party retailers.

A Bitdefender Total Security subscription to cover five devices for one year costs £75, but new subscribers can get their first year from Bitdefender for £50, after which it renews at the standard price. If you buy from an online retailer, however, you'll pay around £30 for exactly the same subscription, without the risk of forgotten auto-renewal fees appearing on your bank statement.

We do like the Bitdefender Central online management portal, where you can monitor the status of devices associated with your account and find



them if they're lost or stolen. It's one of the more capable examples of consumer AV device management, although it lacks the vast power of some business-oriented endpoint protection management interfaces.

The Bitdefender Total Security VPN is a white-label version of Hotspot Shield, which provides a wide range of endpoint locations and, last time we tested it, had generally quick speeds. However, it wouldn't be our first choice of VPN service for region shifting.

The password manager appears to be home-grown, and has clients for Edge, Chrome, Firefox, Android and iOS. Unfortunately, like every password manager that comes with antivirus software, it's far more limited than dedicated tools such as Bitwarden or KeePass. There's nothing wrong with it, but there's just no compelling reason to choose it over better free alternatives.

Regardless of which tier you buy, you'll find Bitdefender easy to live with. The client's main page shows the status of your real-time protection and provides shortcuts for scanning, a VPN, secure browser and a customisable quick action for anything you might use regularly. Most noticeably, it's less intrusive than many rivals. Its messaging, when everything's working, tells you that "you are safe" in big letters, where Avast informed us that our data was at risk unless we bought yet another subscription.

Although there are a good range of security features built into Bitdefender's desktop client, it never feels as crowded or cluttered as some rivals. Under its Protection tab, you'll find a

ABOVE Bitdefender lets you know you're safe without nagging you to upgrade



dedicated firewall interface that's nicer than Windows' own, email scanning for spam and malware, web content protection, whitelist-based webcam and mic protection, and a dedicated Ransomware Remediation module that creates a local backup of files when it detects an untrusted program trying to access them.

There's the usual range of extra tools: a secure file shredder, a system optimiser and Safepay, a hardened browser for online financial transactions. Silent detection modes are automatically enabled when Bitdefender spots you watching something full screen or playing a game.

You can also turn them on manually, which is helpful for games that run in borderless rather than full-screen mode, and they can even be configured to halt Windows Updates.

This is a capable package, and although it's not tested as frequently as some rivals, Bitdefender's performance in anti-malware tests tends to be good. It got perfect protection and false positive accuracy scores in the Q1 2023 Home Protection test by SE Labs, and defended against 100% of malware in AV-Test's battery of tests, with two false positives. It stumbled slightly at AV-Comparatives, but still blocked 99.4% of real-world malware exposures, albeit with six false positives.

Bitdefender Total Security hits a sweet spot in the company's price range, especially if you buy it from a third-party store, and makes a fine, low-interaction alternative to Microsoft Defender.



G Data Total Protection

Dated in places, but it includes affordable, hassle-free malware protection with two detection engines

SCORE

DIRECT PRICE 5 devices, \$82

from gdatasoftware.co.uk

RETAIL PRICE Not available



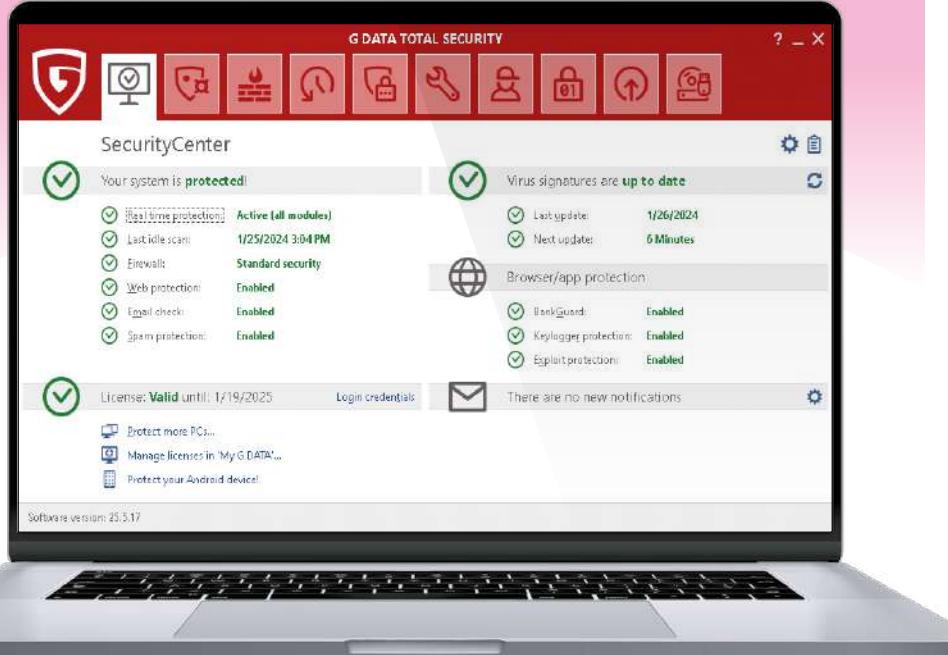
If your priority is to stay safe, there are two good reasons to choose G Data Total Protection: its twin malware detection engines. G Data combines its own engine with Bitdefender's, which is also a reliable performer, helping to keep those detection scores high.

It's better known in its native Germany than in the UK, which is why it isn't tested so widely; the UK-based SE Labs doesn't test G Data, and even in AV-Test (based in Austria) we had to go back to February 2023 for results, where it provided 100% protection.

AV-Comparatives is based in Germany and unsurprisingly covers G Data much more frequently, and here it provided a strong set of scores, albeit not the best. Most recently, it returned a solid 99.6% protection rating with eight false positives. That's just short of the clean sweep we saw last year, but if you'd spent the past 12 months using G Data then it's very unlikely you will have experienced a malware infection.

There's no shortage of scan options if you're concerned. You can run or schedule a full malware scan, or scan specific files or directories, your computer's memory and startup processes, removable media, and also check for rootkits. Other options under Virus Protection allow you to access quarantined files or burn a bootable rescue image to a CD or USB drive.

G Data Total Protection's features haven't changed in any major way since last year's review, which is both good and bad. For example, it's good that you're prompted to install a plugin for Edge, but you'll find references to Internet Explorer scattered throughout the G Data suite. Indeed, parts of the application feel oriented towards Windows operating systems that have been end-of-life for years, and include extra features that cater to older PC hardware configurations.



Discontinued browsers, apps and web services appear in configuration settings and additional software tools, though the disk defragmenter at least automatically excludes drives that it detects to be SSDs. You can override this, but we strongly advise against it.

As we observed last year, the parental controls include an option to block all SSL sites, otherwise known as most of the modern internet. They otherwise work as you'd expect, but that's still not as helpful as Microsoft Family Safety, unless you'd rather not create Microsoft accounts for your children. G Data's password manager is particularly poor, minimally documented, and still only has plugins for Google Chrome and Internet Explorer. Use a dedicated password manager instead.

More sensibly, as many people are still on modest internet connections and need as few delays to their downloads as possible, only downloads of up to 10MB are checked by the G Data Web protection tool by default. The files will also be checked once they've been downloaded, but if you've got a fast PC and internet connection to match, you might want to disable this option.

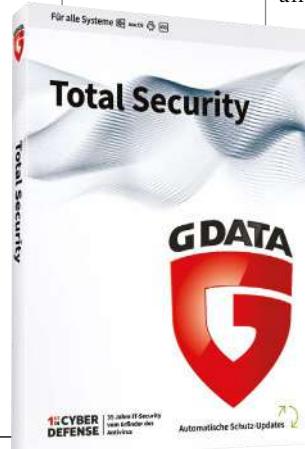
G Data's firewall is simple and easy to work with, and its default autopilot is hassle-free. The backup tool supports differential and incremental backups of any selected files and folders, on the schedule of your choice, to physical media, a network location or a synced storage drive.

Unexpectedly, if you're in the UK, G Data will be sold to you in US dollars, which means \$50 for a one-device

ABOVE G Data is quirky but effective when it comes to malware protection



"There are no hidden price hikes after the first year of subscription, which is a real strength compared to its rivals"



subscription, \$66 for three devices and \$82 for five devices. Whether you buy from a third-party retailer (good luck) or from G Data directly, there are no hidden price hikes after the first year of subscription, which is a real strength compared to its rivals.

G Data Total Security is the premium version of the company's antivirus software, available on Windows and macOS, with iOS and Android apps to go with it. However, we actually recommend that you buy G Data Internet Security (\$40) instead, as this gets you the powerful antivirus engines, plus the firewall, quarantine, cross-platform protection and parental controls – without the performance tuning

and encryption tools, or the clunky password manager. You miss out on the device access controls and backup tool, which is one of the best we've seen built into an AV suite, but let's not forget that Duplicati is free.

In truth, we still find the client's old-school looks rather endearing, and love all the little touches – such as

USB keylogger detection and the ability to include only some of the security suite's features at install time – but it could do with updates for the Windows 11 era (and Windows 10 era), particularly when it comes to its privacy tools.

Nonetheless, G Data provides straightforward, effective and inexpensive protection against malware and other threats to your system, making it one of our favourite security suites, despite its quirks.



Avira Prime

Great malware protection, but it struggles to compete with its own free product

SCORE ★★★★☆

DIRECT PRICE 5 devices, £43 (£52 inc VAT) from avira.com

RETAIL PRICE Avira Prime not available

Avira Prime is the top-tier product from a brand that's best known for its free antivirus package. It includes the same antivirus and firewall modules as the free version, plus a software updater and a password manager that also appear in Avira Internet Security. Neither of these are products you strictly need, as software can and usually should be trusted to check for its own updates, and you ought to be using a dedicated password manager.

Avira Prime also adds Avira's Phantom VPN. This isn't a white-label product but the company's own, and it's a solid choice, if not in the absolute top flight of VPN providers. Prime also includes a clutch of system optimisation, encryption



and data-shredding tools, all of which have free equivalents.

The company was bought by NortonLifeLock, now Gen Digital, in 2020, and is thus a sibling firm to Avast and AVG, but Avira continues to use its own malware detection engine. It's a good one, as shown by its detection performance, and you'll find it used in lots of other companies' antivirus products, including F-Secure, TotalAV and Sophos.

The client has a minimalist interface that's the same across all of its product pricing tiers. A Status tab just shows you a notice that your antivirus is active, three entirely non-interactive graphics marked Security, Privacy and Performance, and a button to initiate a smart scan.

ABOVE Avira uses its own detection engine, and it's a good one



As well as checking for malware, this scan will also offer to clear some temporary files, update your software files or clean up Registry entries that Avira deems unnecessary, most of which you probably don't actually need it to do. One particularly useful Prime feature, compared to the free version, gives you access to optimised power profiles, improved startup times and a "game booster" mode for silent detection. Separate interfaces can be launched for both Avira System Speedup and Phantom VPN, but these are integrated into the main Avira install, and don't need to be removed separately if you ever wish to uninstall it. The password manager is, as you'd expect, web-based.

Avira Prime costs £52 for the first year but renews at £91. You can subscribe to it monthly if you don't think you'll need it for that long. We couldn't find it at retail, but Avira Internet Security for three devices can be bought in shops for £30.

Avira has a low system impact, effective protection and, apart from being a little too keen on system optimisation, doesn't try to interfere in your day-to-day activities as much as the likes of AVG. However, its malware protection can't quite match the best and its paid-for features don't justify its cost.

Eset Home Security Ultimate

A great VPN, but only adequate performance in recent AV tests

SCORE ★★★★☆

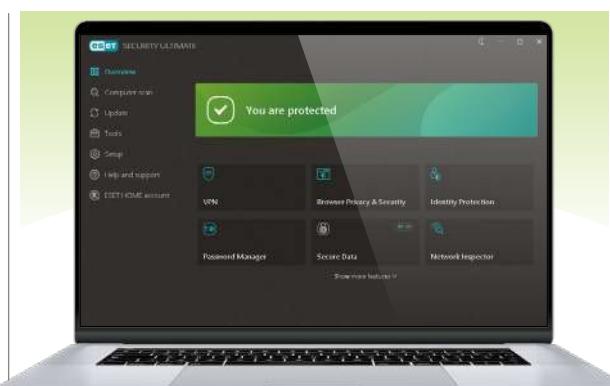
DIRECT PRICE 5 devices, £96 (£115 inc VAT) from eset.com

RETAIL PRICE Not available

Since last year's review, Eset has retired its Internet Security suite branding and revamped its consumer antivirus into its new Eset Home Security range. There are three tiers, starting with Essential. Alongside the usual antivirus and online threat detection, this offers parental controls, webcam protection, a firewall, Android anti-malware and anti-theft for your devices.

The Premium tier adds a password manager, iOS protection and encryption tools, plus the cloud-based LiveGuard scanner; this runs potential threats in an isolated sandbox.

The Ultimate tier includes all the features of Essential and Premium,



plus a VPN for Windows, macOS, Android and iOS. The privacy policy states the VPN logs aren't retained and Eset told us it was using a white label VPN from a third-party provider. On testing, we discovered that this was Windscribe. That's excellent news. Windscribe is consistently among the top performers in our VPN tests.

Eset Home Security Ultimate costs £115, with no first-year discounts and no deceptive renewal costs. We couldn't find retail copies of Ultimate in the UK, but the Premium version is available for £45 from Amazon.

Eset only released its client refresh towards the end of 2023, which means it came out after most of the third-party tests we rely on. However, the underlying malware detection engine

ABOVE Eset has an attractive, well-organised interface



gets constant rolling updates, so the test data is accurate, despite cosmetic changes to the user interface.

And they really are very appealing changes. The new-look client defaults to a pleasing anthracite interface with green and turquoise highlights (a light mode is also available) and neatly sorted options. The advanced settings are buried behind a small link at the bottom of the main interface's Setup tab, but you can always press F5.

Other features include a gamer mode that activates automatically when something's running full screen, webcam protection and even a clever anti-theft measure. This creates an unsecured "phantom account", a honeypot for thieves or would-be tamperers, which will send you an alert if anyone tries to sign into it.

In AV-Comparatives' latest real-world test, Eset performed poorly, with a Protection score of 98.2% blocked, albeit with no false positives. It was last tested by AV-Test at the beginning of 2023, where it scored 98.9%, netting it an overall Protection score of 5.5 out of 6.

Eset is great to use, comes with helpful features and has the best VPN here. However, its relatively poor malware detection performance means that it can't compete against the likes of Avast.

Best free antivirus

Don't want to pay for a full security suite? We reveal the best free choices, depending on what you're looking for

This year, our group test has conspicuously focused on top-of-the-range security suites, brimming with extra features. Think VPNs, parental controls, password managers, identity theft insurance and recovery services. We included only one free antivirus suite, Windows Defender Antivirus, because it's both the operating system default and a solid benchmark against which to judge all the others, even if its performance in detection tests suffered a minor slump during the latter half of 2023.

However, a key takeaway from these reviews is that, although these extra tools can help you retain your online privacy or even provide a second layer of detection, the core malware-detection engines remain the same across most vendors' different tiers.

That means that, when it comes to pure malicious software detection, Avast Free is as effective as Avast Ultimate. Of course, not every vendor has a free product, and not every free product provides real-time detection. In other words, they'll only look for threats when you run a scan, rather than remaining in the background and checking new files and online activity for threats as you go.

So, if you don't want to pay, what are your best choices? That's what we seek to identify here.

Best free antivirus: Avast and AVG

We've grouped Avast and AVG together because they use the same detection engine and are effectively the same software. Both free products provide excellent malware protection – if you dig into AV-Test's results, you'll see they're the same for both AVG Internet Security (paid-for) and Avast Free.

Either of these companies' free suites will do the job when it comes to defending your PC and, at the moment, they're doing that better than Microsoft Defender. Avast and AVG Free also include opt-in ransomware security that watches for suspicious changes in specified directories and a local networks security scanner.

Avast One Essential, which is also free, includes a breach-detection service (similar to that available at haveibeenpwned.com), 5GB a month



ABOVE Avast and Malwarebytes offer effective free tools

of VPN services, and a few system optimisation tools. But, once again, it's the malware-detection engine that counts here.

Best on-demand scanner: Malwarebytes

Malwarebytes' free scanner has an incredible reputation exactly because it doesn't provide real-time protection. It scans what you tell it to, when you tell it to, which means that it can't get into fights with any other real-time antivirus you might have installed. Nor does it interfere with any software, until you command it to run a check. That's obviously popular with software developers, game

modders and anyone who might be working with files likely to get identified as potential threats and yanked away into quarantine.

Malwarebytes isn't tested as much as it deserves to be, but AV-Test regularly features its paid-for Internet Security version, which usually gets a consistent protection

A key takeaway is that the core malware-detection engines remain the same across most vendors' different tiers

score of 5.5 out of 6, typically because it misses a couple of zero-day threats during the real-world tests.

It's worth noting that paying Malwarebytes customers get real-time protection and almost every antivirus tool also allows you to disable real-time protection.

Best single-file scanner: VirusTotal

If scanning a whole directory seems like overkill but you think that file over there looks a bit dodgy, then you may want VirusTotal (virus-total.com). This Google-run web service allows you to upload a file or submit a URL and then scans it with detection engines from multiple anti-malware vendors. You do need to know what you're looking for, though, as we've found that obscure files and some older software routines often trigger false positives from some of the twitchier detection engines.

Best free Linux AV: ClamAV

Literally the only antivirus tool most desktop Linux users ever encounter, this Cisco-maintained open-source project also appears in a lot of server-side email threat scanners, and is one of the scanners used by Cisco's enterprise endpoint security products. ClamAV is unusual in that you can load it with different signature databases, so the version used as one of the scanners in Cisco's proprietary products will differ to the ones you download, but you can also add third-party signature sources such as Malware Patrol.

It's a good choice if you want to check suspicious files on a non-Windows PC, but we'd generally recommend that Windows users install something with plenty of test results to back up its performance.

Free rescue tools

A number of the security suites on review allow you to burn a bootable rescue disk, usually a minimalist Linux distro that runs a version of the scanner to find and repair any malware infection on your hard disk while it's not mounted. This is a good approach to clean up an active malware infection. Although these rescue disks aren't as widespread as they once were, a couple of big players still put them out. Try:

- Avira Rescue System: tinyurl.com/355avira
- Eset SysRescue Live: tinyurl.com/355esetrescue
- Norton Bootable Recovery Tool: tinyurl.com/355norton



Kaspersky Premium

Effective antivirus that you might not be allowed to use for work

SCORE ★★★★☆

DIRECT PRICE 5 devices, £19 (£23 inc VAT)

from kaspersky.co.uk

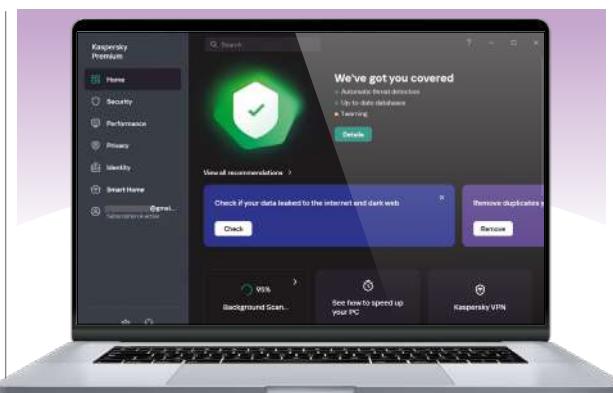
RETAIL PRICE 5 devices, £14 (£17 inc VAT)

from amazon.co.uk

Kaspersky is in the awkward position of providing highly effective protection against viruses, alongside numerous ethical and practical problems in the context of the Russian government's ongoing invasion of Ukraine and Kaspersky's contracts with the Russian state.

The UK National Cyber Security Centre doesn't regard Kaspersky software to be a threat to individual users. However, the software has been banned by many public sector and some private sector workplaces, which you should be aware of if you use your PC for work.

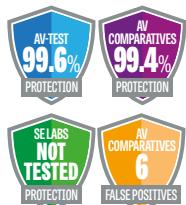
Kaspersky Premium includes the company's Safe Kids parental controls, 24/7 remote IT support



for security issues, and identity protection features. The latter aren't as heavy-duty as those from McAfee and Norton – there's no service to remove your information from data brokers, for example. They instead involve remote access detection, an encrypted wallet for digital copies of your identity documents, and an expanded version of the data leak checker available to Kaspersky Plus users. This checks to see if your phone number, as well as your email address, has appeared in any breaches.

You also get a VPN; it's fast but poor for region-shifted streaming. Other extras include the usual system optimisation tools and a mediocre password manager, which at least works well as a

ABOVE Protection is good, if you can ignore geopolitical concerns



standalone service if you ever wish to switch antivirus providers.

Kaspersky wasn't the best all-round performer in our most recent test data, but its performance remains strong. It aced SE Labs' battery of real-world tests with scores of 100% all round, but dropped to 99.2% accuracy in one of AV-Test's pair of month-long real world tests, and got a protection score of 99.6% with two false positives in AV-Comparatives' real-world test.

As with many antivirus suites, Kaspersky Premium costs more if you subscribe directly, albeit not by as much as some rivals. A one-year, five-device subscription costs £58, reduced to £23 for new customers. That's still less cost-effective than buying from a third-party retailer: you can currently buy Kaspersky Premium on Amazon for £17, which is definitely the best way to do it.

There's nothing wrong with Kaspersky's product – its malware protection is very good, in fact – but many will feel that there's no compelling reason to use antivirus software that periodically gets mentioned in the context of an armed conflict. Meanwhile, in terms of pure performance, Avast (and AVG, which uses the same engine), swept to a clear win and is a better choice.

McAfee+ Advanced

Expensive protection with lots of features, but merely decent malware protection

SCORE ★★★★☆

DIRECT PRICE Individual, £63

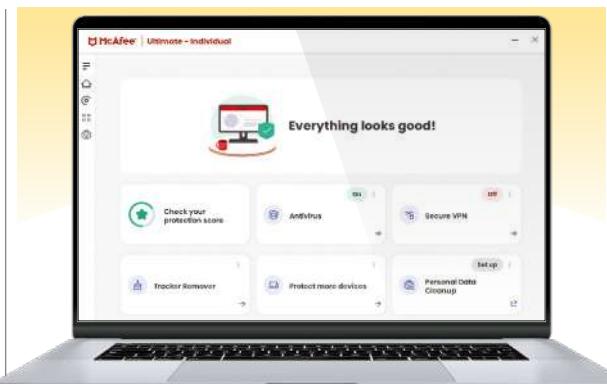
(£75 inc VAT) from mcafee.com

RETAIL PRICE Not available

McAfee is one of the most expensive security suites around, but it is trustworthy: ever since Intel spun it off into an independent company, its long-term performance in malware protection tests has significantly improved.

Unfortunately, McAfee's recent performance leaves something to be desired. It achieved 100% protection in AV-Test's most recent tests, with just two false positives, but got an unexpectedly poor 96% rating from SE Labs, albeit with no false positives. It returned a decent but not world-beating 99.6% in AV-Comparatives' latest tests with six false positives.

All McAfee+ plans come with some degree of identity protection, but in Premium this is a scan-only feature to



encourage you to upgrade. The Advanced and Ultimate tiers include tools to automatically tweak popular social media settings for privacy, a personal data cleanup service that will request your removal from data broker listings, and identity theft insurance.

The Secure VPN uses TunnelBear's fantastic infrastructure, which is quick but not much use for streaming. And you can only use it via McAfee's own clients, so forget about adding it to a router, server or Linux PC. You get real-time and scheduled scans, a software updater, cookie and tracker remover and an online security portal.

There's a password manager, too, but this is as adequate as all built-in password managers tend to be.

McAfee has discontinued its dedicated

ABOVE McAfee offers decent protection, but at an indecent price



firewall, and now provides a limited front end for the Windows Defender Firewall. Unfortunately, this means you now need to go to the Windows firewall if you need to create inbound rules. In fact, if you created any with the old McAfee firewall, you'll have to re-create these following a software update to the new version.

We also need to talk about price. McAfee+ Premium costs £110 per year for individuals and £130 for a family subscription, which includes parental controls. Advanced costs £160 for an individual and £230 for families. And Ultimate costs an even heftier £170 for individuals and £350 for families. They can all be installed on an unlimited number of Windows, macOS, Android, iOS or ChromeOS devices.

Naturally, McAfee doesn't shout about these prices on its website, instead luring people with first-year discounts for new subscribers. That's £170 for Ultimate, £75 for Advanced and £50 for Premium, but make sure the renewal fees don't surprise you. We couldn't find retail bundles of the McAfee+ range in the UK, but head to store.pcpro.co.uk and £20 buys the ten-device version of McAfee Total Protection. This gets you the antivirus and VPN component – but lacks bells and whistles such as the identity protection – and is a much better deal.

Microsoft Defender Antivirus

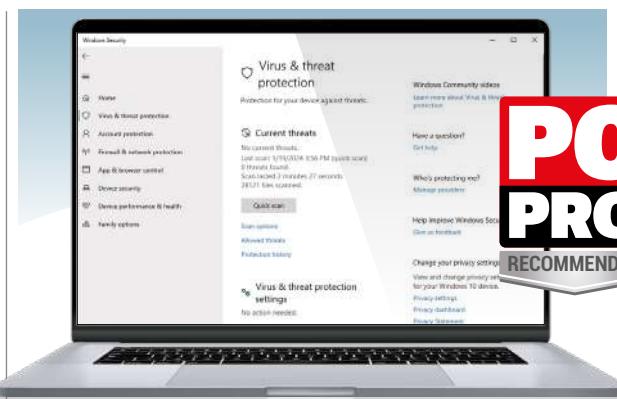
Windows' integrated security doesn't provide the best protection but it's hassle-free

SCORE ★★★★☆

DIRECT PRICE Free with Windows
RETAIL PRICE Not applicable

Microsoft Defender is Windows' integrated malware protection, and with detection performance that compares well to both free and paid-for rivals, it's good enough to rely on for security. As we discussed last month (see issue 354, p36), the "Defender" naming scheme is confusing, but this is a review of free Microsoft Defender Antivirus and related tools that are built into the Windows 10 and 11 Security app.

These include real-time protection against malware, various on-demand scans and the creaky-to-configure but effective Windows firewall. Microsoft Family Safety is one of the best parental control suites you can get for Windows, and also covers Android and iOS.



PC PRO
RECOMMENDED

There's even dedicated ransomware protection, which both monitors protected folders for unauthorised changes and can sync important files to Microsoft's OneDrive cloud storage.

You can enable reputation-based protection against unwanted apps and websites. SmartScreen will check any file or app, and has specific malicious download defences for Edge and the Microsoft Store. Protection against known exploits is on by default, but you can also deploy custom profiles for particular programs.

Perhaps the best thing about Microsoft Defender is that it doesn't try to sell you anything and it keeps alerts and pop-ups to a minimum. Many users will never have to interact with it at all. This makes it a great

ABOVE Defender is a great set-and-forget anti-malware option



option if you're setting up a Windows PC for a less technical person who might be easily alarmed by warning messages or upgrade prompts that promise bonus security features.

The interface is generally easy to use. You'll find controls for real-time malware protection and on-demand scans, configuration of your ransomware protection, plus links to your firewall and parental controls. Depending on your hardware, your device security settings may give you access to heightened security measures such as core isolation and memory integrity to keep malware at arm's length from your system's core processes. These are on by default in Windows 11 and can be enabled in Windows 10, and most users won't need to touch them.

AV-Test's data, as usual, shows that Defender is slower when it comes to launching websites and installing software than some rivals, and it also dropped to 99.2% accuracy in one month's real-world test. It got perfect scores in SE Labs' tests later in the year, but only a 98.8% protection rating in AV-Comparatives' tests.

So while it's not the best performer (see our free AV software guide on p89 if you want more) it's a great choice if you don't want to deal with licences, subscriptions or upgrade pop-ups.

Norton 360 Premium

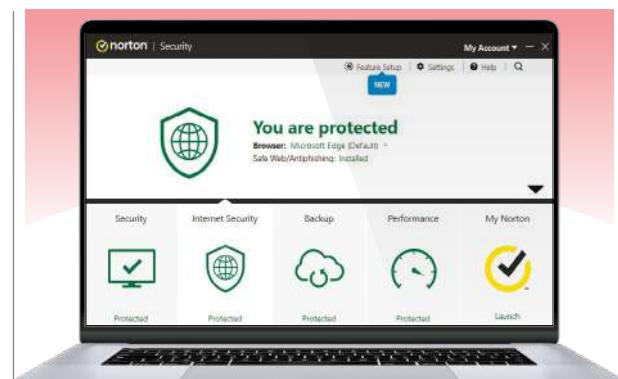
Good security but a confusing range of price tiers and an obnoxious renewals process

SCORE ★★★★☆

DIRECT PRICE Deluxe, 5 devices, £74 (£89 inc VAT) from uk.norton.com
RETAIL PRICE 10 devices, 2yrs, £17 (£20 inc VAT) from store.pcpro.co.uk

Norton 360 is, along with McAfee, as close to a household name as you'll get with antivirus. It's been part of the security landscape for over 30 years, in the hands of a variety of companies. It's no longer any relation to the Symantec range of business security services, but instead is a brand-mate of Avast and Avira, among other consumer-focused tools.

There are plenty of choices for would-be subscribers. We bought a two-year licence from the PC Pro store for £20 and were informed it would automatically renew at £100, subject to price changes. This is all due to Norton, we should add, as it forces you to enter your card details and sign up for a recurring subscription – and it's



charged up to 35 days before the subscription is due for renewal. We manually cancelled the automatic renewal once we'd completed signup, and recommend you do the same.

The version we bought is more or less equivalent to the Deluxe tier available from Norton's website. It comes with 75GB of storage for online backups and ten user seats for two years, but other tiers are available with cloud backup storage of up to 200GB.

You also get the standard Norton Premium components: a password manager, parental controls and Norton's own VPN. There's also dark web breach monitoring for a range of personal information, rather than just an email address. Norton also provides identity protection features in its

ABOVE An effective defence, but beware the renewals process



Advanced tier, including credit rating monitoring and an identity theft remediation helpline. Although it's handy having everything in one subscription, Norton's VPN service is unremarkable by the standards of the industry, and its password manager is functional but lacks features compared to Bitwarden.

Norton provides consistently effective protection against malware, although it had an unusually low score of 98.8% in AV-Comparatives' most recent tests, with 17 false positives. More impressively, it got perfect protection scores from SE Labs and AV-Test without misidentifying any benign software as malware. AV-Test found that it had some impact on system performance, though, particularly when it came to launching websites and installing software.

Norton 360 is perfectly capable and has plenty to recommend when it comes to malware defence and extras. It's even good value when you buy it at retail. However, its insistence that trial users and those who buy keys elsewhere hand over a raft of personal information and enable renewals to even get access to the service is hostile to the user. Avast and AVG, although owned by the same company, have much less stressful sign-up and key redemption processes.

Panda Dome Security Suite Premium

An attractive interface and sensible pricing, but there's nothing remarkable about it

SCORE ★★★★☆

DIRECT PRICE 5 devices, £33 (£40 inc VAT) from pandasecurity.com
RETAIL PRICE Not available

Panda Dome antivirus has a prettier client than most, with soothing landscape wallpaper images you can customise. It's only a shame the icons are so stylised as to be almost meaningless without the small tooltip text that appears next to them.

It's also a shame that AV-Test hasn't touched a version of Panda since 2018, but we've got data from both SE Labs and AV-Comparatives. Historical test data shows that Panda's malware detection has gone from strength to strength since the Spanish antivirus firm was bought by hardware firewall maker WatchGuard in 2020.

In AV-Comparatives' latest tests, Panda netted a 98.6% protection



rating, albeit with 20 false positives. In SE Labs' tests, its protection rating of 97% was better than McAfee, and it scored a 99% total accuracy rating once its perfect performance in the legitimate software accuracy tests (as shown on the right) was taken into account.

Panda is reasonably priced, and it's great to see that renewals are locked to its purchase price. It doesn't have a free trial, but you can subscribe to Panda Dome Security Suite Premium on a monthly basis; this works out more expensive than subscribing for a whole year, but it's good to see more flexible options available. There's also a free version, which uses the same malware-detection engine.

One reason to buy the Premium version is that it includes an unlimited

ABOVE Panda has a nice interface and lots of extra features



VPN. That's great, but it's yet another white-label version of Hotspot Shield with no configuration options to speak of. Premium also includes an update manager and 24/7 tech support, plus all the features of the lower tiers. And it's a long list: password manager, PC-optimisation tools, ransomware protection, parental controls, a firewall, Wi-Fi network security risk scanner, mobile device protection and a secure browser.

The firewall is comprehensive, nicer to work with than the Windows Defender Firewall, and comes with a set of recommended rules with a lower priority than your own. The ransomware defence module is interesting. Off by default, it uses multiple techniques to detect and protect against ransomware attacks, including decoy files, shadow copy backups, and provides a data shield to prevent unauthorised changes to selected files and directories. As with every bundled password manager, Panda's will do the job but you're better off with a dedicated product. Parental controls are easy to use, but no better than Microsoft Defender.

Panda's overriding problem is that it can't offer anything that's convincingly better than the alternatives, including some free products and services.

Trend Micro Maximum Security

Packed with features, but high numbers of false positives count against it

SCORE ★★★★☆

DIRECT PRICE 3 devices, 1yr, £58 (£70 inc VAT) from trendmicro.com
RETAIL PRICE 3 devices, 1yr, £17 (£20 inc VAT) from amazon.co.uk

Trend Micro packs a lot of features into Maximum Security. What's more, it looks good doing it. Unusually for antivirus software, the desktop client's neutral interface is customisable with appealing backgrounds and animations, which make it more pleasant to live with. It also shakes off the unremittingly dour, scaremongering vibes you get from some antivirus suites.

As you'd expect, there's real-time, on-demand and scheduled malware scanning, plus POP3 and IMAP email and spam filtering. You also get a botnet-detecting "firewall booster", plus a browser plugin that blocks



threats in social media, webmail and elsewhere on the web. Its ransomware protection module defends selected directories and their contents against changes by untrusted programs.

Data theft protection monitors the information that gets typed into web apps to prevent you from sharing anything private. There's also a secure file eraser and encrypted file vault creator. We're less excited by its parental controls, a standalone password manager, protection for Android and iOS mobile devices, and a selection of system optimisation tools.

Mute mode, enabled by default, automatically activates when you're in full-screen mode to prevent games, presentations or films from being interrupted. You can also activate it

ABOVE Trend Micro's interface makes it a pleasure to use



manually, have it prevent Windows Update from running and even have Trend terminate selected programs when mute modes are enabled.

We were slightly disappointed by Trend Micro's performance in antivirus tests in 2022, but that improved through 2023. In AV-Test's latest results, it got 100% for all reference malware sample scales, and 100% in one month of real-world testing, but dropped to 99.2% accuracy the next. That was still good enough to get it AV-Test's maximum protection score of 6 out of 6.

While Trend Micro didn't get as many false positive results this year as when we last looked at it, it blocked 35 benign samples as potentially malicious in AV-Comparatives' latest tests. That's still enough to be a problem for nervous users, or those who aren't happy reassessing malware threats off their own bat.

Its recommended prices are lower than its rivals, with a three-device subscription priced at £70 online, but we recommend buying via retail, where the same package costs £20.

Trend Micro is pleasant to use, unobtrusive and will keep you safe - safer than Microsoft Defender at the moment. However, it doesn't have anything to command it above more effective rivals such as Avast.



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Business



Home





How we test

We get hands-on with every single product in the group test, ensuring that its features and interface all work as they're supposed to and highlighting any friction points. However, long-term testing with live malware samples is required to genuinely evaluate how effective any given antivirus solution is at protecting your system against malicious software.

For this, we turn to data produced by a number of well-regarded anti-malware testing houses: specifically, SE Labs in the UK, AV-Test in Germany and

RIGHT SE Labs is a UK-based testing facility



AV-Comparatives in Austria. All three publish their test data and methodologies, making them available to the public, as well as the press and industry professionals. Data for this Labs test came from the following tests:

■ AV-Test Home Windows test October 2023
tinyurl.com/355avtest

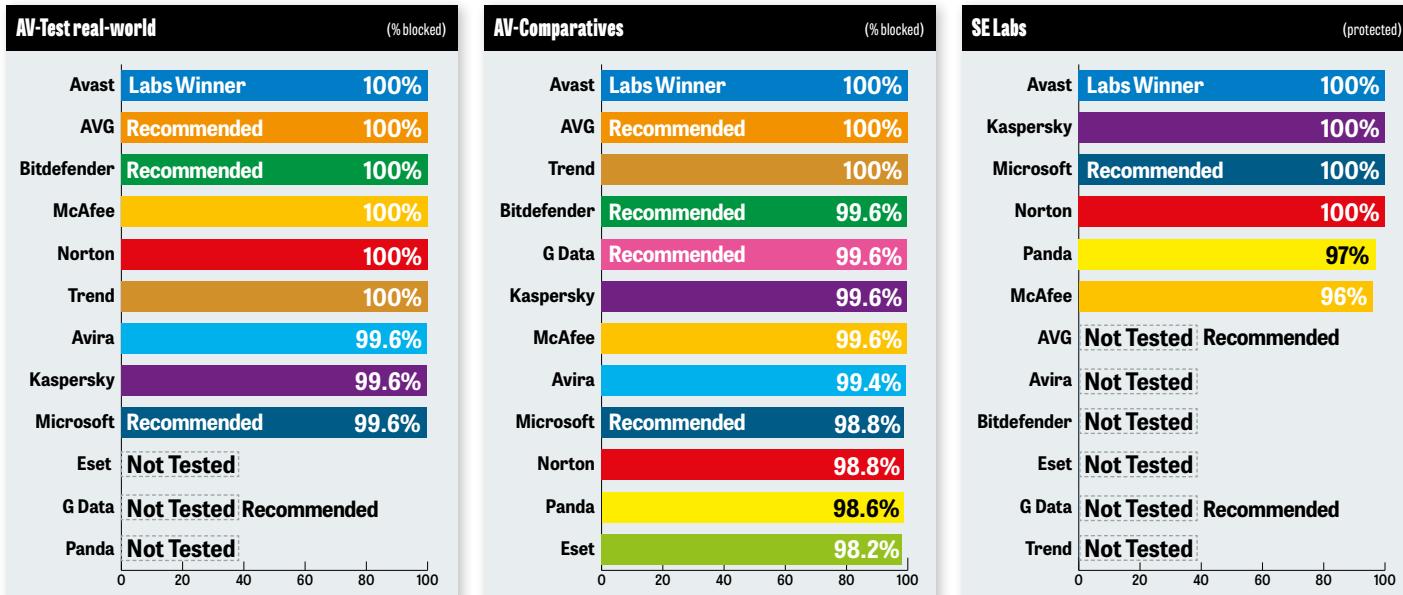
- AV-Comparatives Real-World Protection Test July-October 2023
tinyurl.com/355avcomp
- SE Labs Essential Endpoint Security Home 2023 Q3
tinyurl.com/355selabs

We've used the most recent available data in all cases. If a specific product isn't tested, we use results for products based on the same detection engine. If a product hasn't been tested recently by all labs, we've referred back to historic test data to provide insight into its long-term performance (this includes AV-Test's Jan/Feb 2023 data and SE Labs' tests from Q1 2023).

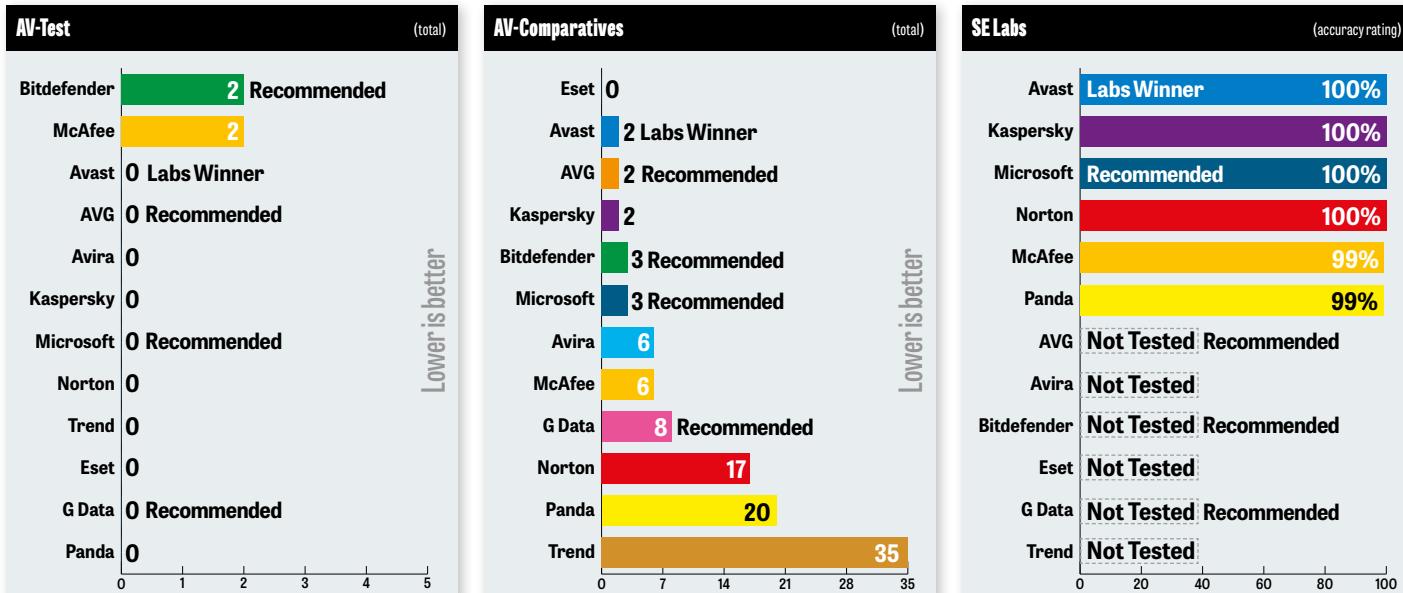
In evaluating test data, we place the greatest weight on "real-world" testing, in which antivirus software is exposed to live malware samples in a realistic scenario, such as web exposure, rather than flat file scans of a large collection of malware samples.

We also take into account performance impacts, measured by AV-Test, and false positive identifications of legitimate software.

Protection



False positives



View from the Labs

Why is online shopping still fraught with traps when you buy AV software?

If you turn to our feature table on p80, you'll see that we've listed three separate prices for most of these antivirus suites. "Renewal price" is the annual price you'll be charged on subscription renewal if you subscribe directly from the company's own website. It can be somewhat hidden, as it's often significantly more expensive than the second price we list – the new subscriber offer, which we've labelled "First year's price direct".

There can be a huge disparity between these prices. For example, your initial McAfee+ Advanced subscription may cost £75 inc VAT, but renewing it will come in at £160. A ten-device subscription to Norton 360 Premium Advanced costs £35 for the first year, but renews at £150. Our Labs Winner, Avast Ultimate, costs £65 for the first year, but then goes up to £110 for a ten-device sub.

This is made worse by the commonplace practice of automatic renewals, something that's been enough of a problem that the Competition and Markets Authority (CMA) has both published guidance (tinyurl.com/355guidance) and investigated and even taken legal action (tinyurl.com/355action) against the worst offenders for being insufficiently clear about auto-renewals at a higher price. And for making it too difficult to cancel them. This has led to marked improvements in the signposting of auto-renewing subscriptions from



KG Orphanides specialises in security topics and provides a quarterly VPN testing service at vpndatatracker.com

[@kgorphanides](https://twitter.com/kgorphanides)



ABOVE Buying an antivirus suite can come back and bite you if you don't check auto-renewal policies

most of the industry, particularly for UK customers.

However, this improvement hasn't been entirely consistent. When reviewing Norton 360, I found that, even if I had a code bought from a third-party retailer, I was obliged to enter my payment information and agree to an auto-renewing

subscription before I was allowed to activate said code. The CMA's 2021 compliance principles for antivirus auto-renewal states that AV firms should "make sure... customers are able to

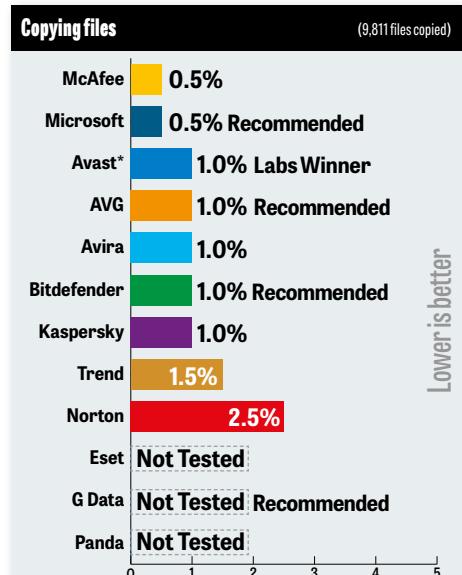
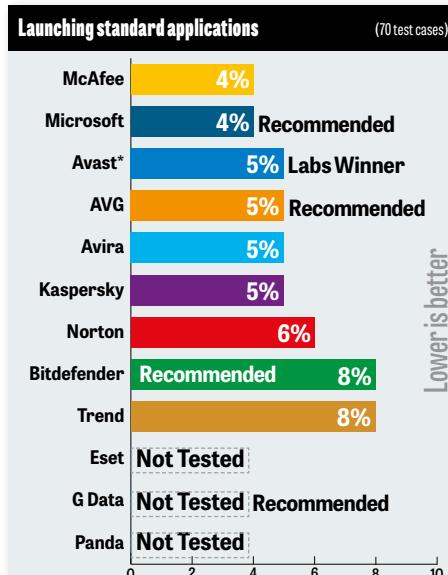
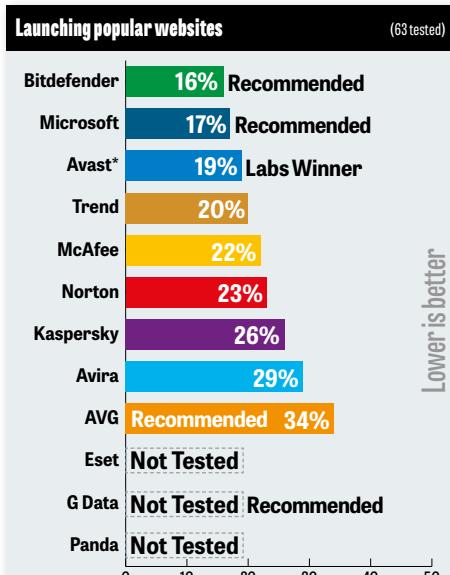
make a fully informed choice about auto-renewal". Although it was easy enough to immediately deactivate auto-renewal on Norton's subscription page, requiring auto-renewal for a key purchased elsewhere feels like it's sailing awfully close to the wind with regards to the CMA guidance.

By contrast, some antivirus makers are deliberately avoiding renewal free price hikes. This virtuous category includes Eset, G Data and Panda. Many others are extremely clear about renewal fees, and some make auto-renewal opt-in, rather than opt-out. These are things I want to see more of across the industry.

However, the most cost-effective way of getting antivirus software, particularly from bigger firms that use deep discounts to attract new subscribers, is to buy it from a third-party retailer. This generally gives you more control of what you pay and what you commit to, making it easy to change providers from year to year. Not all packages or vendors sell through retail – there's a market trend against retail keys as AV makers seek to lock customers into a pattern of regular auto-renewal – but if you can buy and activate keys without too much personal inconvenience, I recommend you do so. ●

"Some antivirus makers are avoiding renewal free price hikes. This virtuous category includes Eset, G Data and Panda"

Performance



*Free version tested rather than full security suite

The Network

Practical buying and strategic advice for IT managers and decision makers

Buyer's guide

Cloud file-sharing services

Dave Mitchell explains why a business-class cloud file-sharing service makes more sense in 2024 than ever



Cloud file-sharing is the perfect partner for businesses that have embraced hybrid working practices. It provides staff with secure ways of sharing documents and collaborating on projects with colleagues and partners irrespective of where they're located.

There's no need to invest in complex and expensive VPNs to securely link remote workers to the main office systems. With cloud file sharing, they can easily work on documents anytime, anywhere and from their choice of device.

Employers railing against hybrid working need to acquaint themselves with the UK government's Flexible Working Bill, which came into law in December last year, as this gives employees greater choice over when, where and how they work. Previously, they needed to have worked with an employer for 26 weeks before they could put in a request for flexible working but, as of April this year, the law gives them the right on day one to request it, and employers are required to consider any request and provide a reason before rejection.

The good news is that increased demand is keeping prices down, making cloud file sharing more affordable. This month, we test business-focused cloud services from Box, iDrive, ShareFile and Tresorit and put them through their paces in the lab to help you make the right buying decision.

Planning permissions

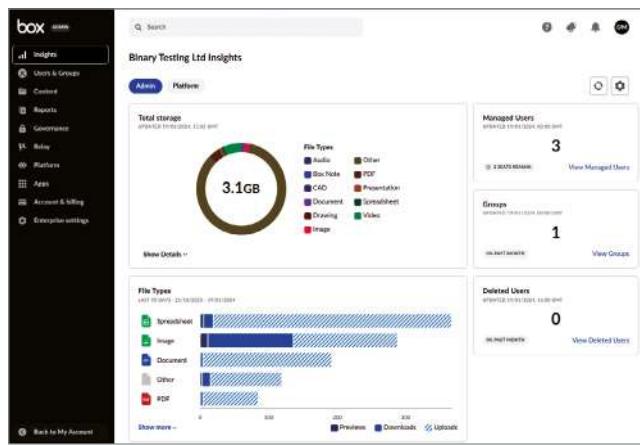
All good file-sharing providers offer a range of cloud storage plans, allowing businesses to choose one that best fits

their needs. Avoid free personal plans, as most have capacity restrictions on cloud storage, along with strict limits on the size of files you can transfer.

Business plans offer much higher storage capacities and more generous limits on file sizes. Prices are based on the number of users, so make sure you only pay for what you need but check whether plans can be upgraded or downgraded later on as your needs will invariably change over time.

You should confirm the maximum allowable file size, as this varies considerably across vendors. Most plans start at 5GB, which will be enough for most SMBs, but those that need to transfer very large files such as medical images or CAD drawings will want a much higher limit; one vendor in our guide supports file sizes of up to 100GB.

Business plans provide an administration web portal for managing your company's cloud account and deciding who's allowed to access it – a feature you won't find in free plans. Check the billing options, too,



BELOW The Box portal provides a breakdown of all file-sharing activities



as if you're prepared to make a longer-term commitment, substantial discounts can be made with yearly contracts.

Travel agents

Administrators can

use their web portal to manage access, with the best ones providing strict controls over who can share, receive and send documents. Onboarding is simplified as they can use the portal to send email invitations to selected users who then set up a personal account and password-protect it.

Real-time file syncing requires a small agent or app installed on each user's computer or mobile device, with most providers including a download link in the email invitation. This makes cloud storage incredibly convenient as the agent automatically syncs all files in selected local folders with the cloud so users are always working on the latest version no matter where they are.

Cloud file sharing doesn't need to be a separate business process, either. Many providers can integrate directly with popular cloud apps such as

Microsoft 365, Google Workspace, Slack and Salesforce. Companies looking to replace pen and paper with digital workflows for signing contracts and agreements will find many providers now work with electronic signature apps such as Adobe Sign.

Look for plug-ins that snap directly into Microsoft Office as these allow users to open documents, edit them and save them directly to the cloud. Integration with email apps is another valuable feature, as it circumvents any restrictions imposed by mail providers on large message attachments. Instead of attaching files to an email, the plug-in allows users to send encrypted emails with web links to files residing in secure cloud storage.

Play it safe

Confidential data must be protected, and a minimum requirement from your provider is AES-256 encryption of data prior to transmission and at rest in their cloud data centres. For

even greater security, look for services that encrypt shared

ABOVE LEFT iDrive doesn't require external users to have an account to access files

ABOVE Good auditing allows Tresorit admins to see which devices are accessing files

data on the users' devices and offer zero-knowledge encryption so only you have access to the keys.

Other valuable features are facilities for users to securely send large files to other users or external clients by creating a web link directly from their personal web portal. For increased security, consider services that let you password-protect links, apply download limits, set expiry dates and request notifications when files are accessed.

Good providers offer controls that allow you to set policies that ensure users create strong account passwords that adhere to a minimum format and length. To add extra layers of security, look for services that offer two-factor authentication and those that work with single sign-on providers.

Auditing is an essential feature if you're required to demonstrate

compliance with data protection regulations. The best services provide full user activity logging and facilities to pull up detailed reports on administrative activities, file accesses, sharing permissions, recipients and so on.

"Auditing is an essential feature if you're required to demonstrate compliance with data protection regulations"

Travelling light

Mobile support is an essential business requirement that allows users to access shared files from their phone or tablet while out of the office. Features vary considerably, but all the best providers offer free iOS and Android apps, with some including advanced features such as using your device's camera to scan documents and send them directly to your cloud account without storing them locally.

Other considerations that will help SMBs choose the right provider are price transparency accompanied by clear descriptions of the features included in each plan. The four products chosen for this guide show pricing details on their websites and are all available as free time-limited trials so you can take them for a test drive before making a commitment.

LEFT The best providers include mobile apps so users can share files on the road



Box Business Plus

A classy cloud collaboration service with a generous storage capacity and an app integration for every occasion

SCORE ★★★★★

PRICE £20 exc VAT per user per month
from [box.com](https://www.box.com)

SMBs that want a cloud file-sharing service that snaps neatly into their existing workflows will love Box, as it offers more app integrations than most of its rivals – over 1,500 in fact. Even better, admins can control which third-party apps are to be made available, and users can browse and install them directly from their personal web portal.

There's a lot more to Box than that, however. It's packed to the gills with collaboration tools: along with the obligatory cloud file-sharing and syncing services, it provides facilities for issuing file upload requests to external users, strong access controls for shared files, Box Preview for viewing and editing files in a browser without downloading them, Box Relay for automating repetitive tasks and Box Notes for taking real-time meeting minutes.

The new Box Canvas adds an extra sharing dimension that allows you to create secure virtual whiteboard sessions. Users can access this from their web portal, start sessions, invite other users and employ a selection of templates as well as drawing and editing tools to create interactive meetings, training sessions and more.

Box is available in five plans, with the Business Plus on review starting

The screenshot shows the Box web interface. On the left is a sidebar with navigation links like Insights, Content, Reports, Governance, Relay, Apps, Admin, and Enterprise settings. The main area has two tabs: 'Analytics' and 'Metrics'. Under 'Metrics', there's a bar chart for 'File Types' and a line graph for 'Hourly Activity'. Below these are sections for 'Managed User Activity' and 'Recent files'. The right side shows a list of 'Recent files' with details like file name, size, and last modified date. A 'Sharing' section at the top right lists users and groups with options to share or edit.

at three users and costing £20 each per month when billed annually. It enables a 15GB maximum file size, a 50-file version history, includes initial access to ten app integrations and gives value a big boost by offering unlimited cloud storage.

User onboarding is swift and they'll find the web portal very easy to use. It opens with an overview of all their files and folders, and shows the most recent documents across the top. The left menu bar provides one-click access to all tools including Notes, Relay and Canvas.

When sharing content with team members, users can apply one of seven access permissions, ranging from viewing only to full editorial rights, and receive notifications when anyone accesses them. Box Collections is a smart feature that allows users to organise files, folders and web links in personal logical groups in their web portal without having to create new shared folders for them.

Install the local Box Drive app from the portal's Sync page and you'll receive a mapped drive with quick access to cloud files. You can mark any for offline

ABOVE Box provides free iOS and Android mobile apps

access so they're downloaded and stored locally and changes made are synced back to the cloud when internet access is restored.

Microsoft Teams users will find the Box app a worthy addition. We added it to our Teams desktop app and, after logging into a Box account, it presented an interface that's a near-perfect replica of the web portal.

Business Plus supports unlimited external collaborators – people outside your organisation that are invited to work with you on shared files. They require a Box account to access them, but this isn't a deal breaker as when we

shared a file using an email address outside our account domain, the user was prompted to create a free Box Individual account, which provides 10GB of cloud storage and a 250MB file upload limit.

There are no such limitations on file upload requests, as external users don't need a Box account for this. Users select a folder, create a file request, paste the web link into an email and send it to the recipient, who drags the required files into the web page to send them.

Box Business Plus delivers a superb range of cloud file-sharing and collaboration tools at a price that is sure to appeal to SMBs. It supports an incredible range of app integrations and tools, delivers strong access controls and neatly amalgamates everything into a well-designed web portal.

REQUIREMENTS

Windows 10, macOS 13, Android 11, iOS 15 upwards



“Install the local Box Drive app from the portal’s Sync page and you’ll receive a mapped drive with quick access to cloud files”

BELOW Box Insights keeps admins apprised on all file activity

The screenshot shows the Box App Centre. The left sidebar has categories like All files, Videos, PDFs, Sign, Relay, Apps, Terminal, Web, My collections, Favourites, Box Syncing Tools, PC Pro Performance Tools, and PC Pro Projects. The main area shows a grid of popular integrations: Box for Office, Box for Google Workspace, Box for Microsoft Teams, Box for Salesforce, Box for Outlook, Box Excel Online Previewer, Box for iOS, Box for Android, and Box Sync for Mac. Each integration has a brief description and a 'View details' button. To the right, there are three smaller windows showing the Box mobile app interface on an iPhone, the Box Sync app interface, and a preview of the Box web interface showing a file list for 'Lake Wood Preservation'.

IDrive Business

A top-value cloud backup service, but file-sharing and collaboration features are merely an afterthought

SCORE

PRICE 250GB, £55 exc VAT for first year from idrive.com

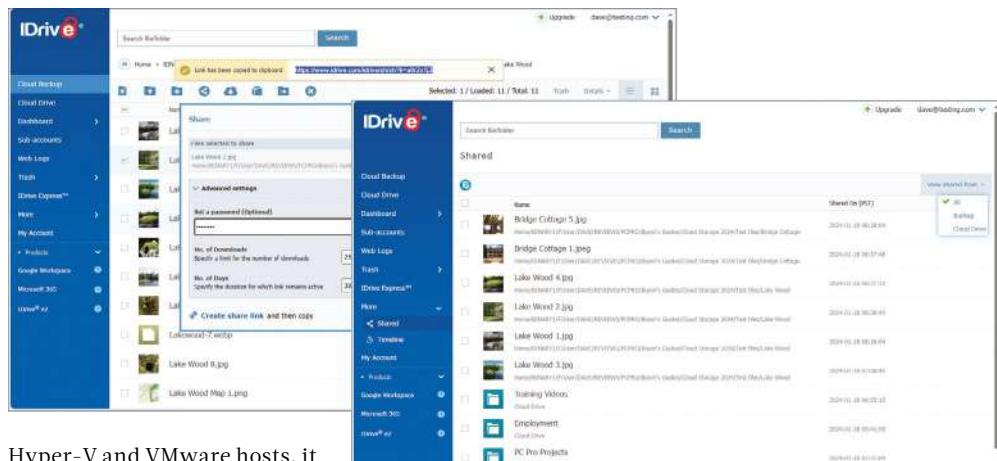
Cloud backup and file-sharing services are normally considered two separate business processes, but IDrive turns this notion on its head by combining the two together in one product. IDrive's primary focus has always been on data backup and recovery, but all paid-for versions also include file-sharing and syncing services as standard.

There are limitations: for starters, users can only share files that have already been backed up to IDrive's cloud servers. Furthermore, when setting up IDrive accounts, you must select the default AES-256 encryption key as file sharing isn't supported if you choose a private key.

Clearly, this service is only cost-effective if you plan to make full use of its backup services. The good news is that IDrive is then incredibly good value, with its top-tier Business plan with 250GB of cloud storage costing only £55 per year. As shared files are already in the cloud, they won't eat into your storage quotas.

That starting price looks even more appealing since it includes unlimited users, Windows, macOS and Linux systems with mobile apps available for iOS and Android.

What's more, along with support for



Hyper-V and VMware hosts, it includes options for securing Exchange, SQL, Oracle and SharePoint servers, with the latest version introducing optional cloud-to-cloud backup for Microsoft 365 and Google Workspace accounts.

Onboarding users is a pleasingly straightforward process: you simply issue an email invitation from the IDrive web portal with a custom message for extra authenticity. Clicking on the message link allows users to set up a new account, password-protect it and choose the default encryption key option if they want file sharing enabled.

After the creation of an account, users are presented with a personal web portal and the IDrive desktop app is downloaded ready for them to install. All they need to do next is choose the files and folders they want backed up and schedule the job to run regularly.

The file-syncing service creates a default cloud folder location on the user's computer which can be changed from the desktop app. New and changed files in this folder are replicated in real-time to the cloud and to any other device running the IDrive app logged into the same account so

ABOVE External users don't need an IDrive account to access share links

they're all kept up to date with the latest version of the file.

File and folder sharing can be achieved from the Cloud Backup pane in the web portal, the desktop app's Restore interface or the iOS and Android mobile apps. When file syncing is enabled, items can be shared from the portal's Cloud Drive section or directly from your local cloud folder using the Windows Explorer right-click IDrive menu.

For share creation, you're directed to your web portal to complete the process. Advanced settings are provided for applying password protection, limiting the number of downloads and setting a link duration of up to 30 days.

A secure web link is then created, which you copy and paste into an email to the intended recipients. IDrive won't do this for you, and it can't send links directly to other users in your account either.

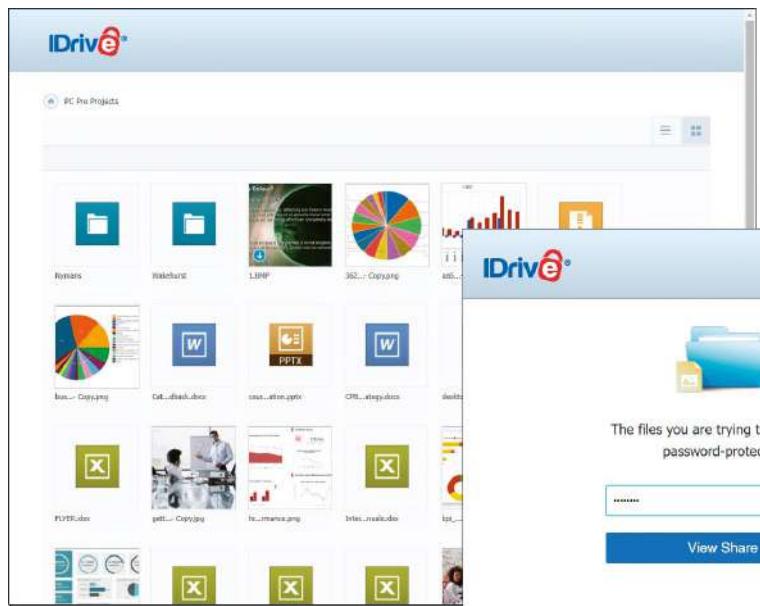
The whole process is a one-way street; you can't issue requests from IDrive to external collaborators asking them to send files to you. View and edit permissions can't be applied to shared items, although IDrive does score over other cloud

services as external users don't need an account to download them.

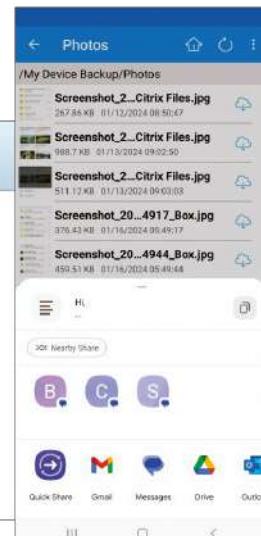
As a cloud backup solution we can confidently recommend IDrive Business but its file-sharing features are very basic. The product is good value but businesses seeking professional collaboration tools and file-sharing services will need to look elsewhere.

REQUIREMENTS

Windows 7/Server 2012, macOS 10.11, iOS 13, Android 4.1 upwards



BELOW The IDrive web portal provides an overview of all your shares





ShareFile Premium

A great-value file-sharing service with tight access security, easy management and support for huge files

SCORE ★★★★☆

PRICE £19.60 exc VAT per user per month from sharefile.com

ShareFile will appeal to SMBs with big cloud collaboration plans as all schemes start at 1TB of storage per user with the option to upgrade capacity as required. Revised pricing makes it even better value, with the top-dog Premium edition on review costing less than £20 per user per month when billed yearly, and ShareFile has lowered the entry price by dropping the minimum number of users from five to three.

Maximum supported file sizes have also changed. The entry-level Standard edition – which costs around £8 per user – supports 10GB, while the generous 100GB limit for the Advanced and Premium versions make them good choices for businesses handling large files such as medical images.

Another compelling feature is ShareFile's support for two types of users. Internal users, or employees, each consume a licence and have full access to all ShareFile features as determined by the administrator, including creating and sharing cloud folders, having their own web portal, accessing other users' folders and managing specific aspects of the company account.

External users such as consultants are classed as clients and don't require a licence so you can create as many as you want. These have access to more

basic collaboration facilities as they don't receive a personal cloud folder, can't share or request files and may access only those they've been expressly invited to by an employee.

Premium's rapid onboarding feature streamlines adding new clients to your account. It emails one-click agreements with auto-fill templates, provides options to e-sign them and tracks their progress using automated workflows.

Creating users is equally swift as they click on the link in their email invitation, create an account and password-protect it, with ShareFile offering a password reset service. Access controls are excellent: during user creation, admins can assign existing personal, shared and favourites folders, set a monthly bandwidth limit in MB, enforce storage quotas and delegate specific permissions from a list of nearly 30 management privileges.

From their personal web portal, employees can view all their folders, drag and drop files into them and share them with other users. Each receives a personal File Box for temporary storage of incoming file requests, and they can install the

ABOVE Along with great access controls, there are cloud connectors for other services

Windows or macOS app for fast cloud file access using a mapped drive.

Integral malware protection scans all files when they're uploaded to the cloud. We tried copying malware files to a user's personal folder and all attempts were blocked with both user and administrator receiving email alerts 30 seconds later.

The Premium edition looks even better value, since it includes an e-signature service with support for sending virtually unlimited documents. It's easy to use: you import Word, text or PDF documents to the web portal, add multiple

signatories, arrange their signing order and email them for drawn and typed signatures.

ShareFile has dropped its Microsoft Teams add-in as it found the Outlook and Outlook

Online plug-ins are more popular. Included in all editions, these allow users to securely send large files, save both the email body and attachment to a ShareFile folder and search folders from within the email app.

The new storage usage dashboard makes it easy for admins to track cloud capacity consumption. It provides details of total account storage usage, along with the top consumers – and then allows you to notify them of their excesses and stop users uploading more files.

Cloud file-sharing features are on a par with many other solutions, but ShareFile Premium stands out for its generous 100GB file size support. Admin feature and access security are extensive and the new pricing structure makes it even more affordable.

REQUIREMENTS

Windows 10, macOS 11, iOS 11, Android 7 upwards

BELOW The web portal and iOS app provide easy access to all features



Tresorit Business Plus

This affordable file-sharing service is ideal for SMBs that demand the highest levels of data security

SCORE ★★★★☆

PRICE £12.83 exc VAT per user per month from tresorit.com

SMBs that are worried about file-sharing security and privacy can rest easy with Tresorit. A great feature of this cloud service is its zero-knowledge policy, which delivers end-to-end AES-256 encryption, and the company never stores keys or passwords, so only account holders and users have access to their data.

Tresorit is good value, and it's commendable that its prices haven't increased for over four years, with the Business Plus plan on review holding steady at £12.83 per user per month when billed yearly. This is a good choice for SMBs: it takes all the features of the Standard plan and doubles cloud storage per user to 2TB, trebles the maximum single file size to 15GB and offers a 100 file-version history.

Along with file sharing, syncing, user and group management, and Outlook, Outlook 365 and Gmail integration, it enables custom portal branding and access audit logs. A choice of 12 global data centre locations is also available for businesses concerned about data residency jurisdiction.

Deployment is swift. You use the Tresorit Admin Center to email invitations to your users and, when they click on the message link, they can create an account and choose a

The screenshot shows the Tresorit Admin Center interface. The main dashboard displays summary information such as the number of users (4), available seats (1), total storage (7 GB), and devices (18). Below this, there are two circular charts: 'Used platforms' (with segments for Windows, macOS, and Linux) and 'Used devices' (with segments for mobile and desktop). On the right, a detailed view of file sharing is shown, listing various folders and their sharing status (Not shared, Shared, Empty), number of members, and file sizes. A sidebar on the left provides navigation links for users, policies, reports, filtering, add-ons, settings, help, and roadmap.

password. You don't need to worry about users forgetting it as the Advanced Control feature includes password reset services.

Once users have downloaded the desktop app, it will create a personal "Tresor" – Tresorit's name for a secure, encrypted folder. You can have an unlimited number of Tresors up to your storage limit, and the app also creates a quick-access Windows Explorer drive mapping or a macOS Finder favourites folder.

Users can share their Tresors with selected team members by choosing them from the desktop app contact list and setting manage, edit or view-only permissions. Two types of Tresors are supported: the entire contents of classic folders can be shared, while next-gen folders allow specific sub-folders within them to be shared.

Tresorit has brought next-gen features in line with classic folders as you can now create and email links to share their files and sub-folders. You can also use encrypted links to place files requested from external partners, including those without a Tresorit account, in next-gen folders.

Integration with third-party apps has also seen improvements.

ABOVE Security policies provide extensive access controls

Tresorit now works directly with Microsoft Teams, and we used our Teams Admin console to decide which users could install the Tresorit add-in on their Teams desktop app. Once logged in, they were able to access and share selected Tresors with other Teams users, upload or download files and create file requests, all from their Teams app.

"Tresorit's zero-knowledge policy delivers end-to-end AES-256 encryption, and the company never stores keys or passwords"

Users can access the optional eSign digital signature service from both the Teams and Tresorit apps. Costing £45 per month for 100 signatures, you create an eSign request, select a

PDF file and email it. Tresorit users can digitally sign the document with one click, while external users confirm their email address, enter the six-digit verification code provided and then sign the document.

Security features are extensive, with Admin Center policies controlling everything users are allowed to do. You can decide what types of devices they can access their account from, stop users from permanently deleting content, block their browsers from storing login details, use IP filtering to limit access from specific locations, enable single sign-on (SSO) and enforce two-factor authentication (2FA).

Tresorit doesn't offer the same levels of integration with third-party apps as many rivals, but it rises to the top with its strict zero-knowledge encryption policy. Excellent value and ease of use make it a great choice for SMBs with cloud file-sharing security at the top of their agenda. ■

BELOW Tresorit offers great account management and monitoring

The screenshot shows the Tresorit mobile application interface. It displays a file library with several images named 'Lake Wood 1.jpg' through 'Lake Wood 7.jpg'. To the right of the library, there are several management options: 'Upload Photos', 'Create Folder', 'Take a Photo & Upload', 'Scan Document', 'Upload File', 'Create File Request', and 'More'. At the bottom, there are tabs for 'All Files', 'Recent', 'Shared Links', 'File Requests', 'eSign', and 'Integrations'. A sidebar on the left shows the user's profile picture and name, 'David Mitchell', along with navigation links for Home, Policies, Reports, Filtering, Add-ons, Settings, Help, and Roadmap.

REQUIREMENTS

Windows 7, macOS 10.9, Android 4.1, iOS 9 upwards, Linux

The screenshot shows the Tresorit Admin Center interface. It displays a section titled 'Policies' with various configuration options: 'Allowed devices' (Windows, macOS, iOS, Android, Linux), '2-step verification' (Optional), and 'Session control' (Enabled). Below this, there is a 'Single Sign-On (SSO) authentication' section with a button to 'Get started to enable this function'. A sidebar on the left shows the user's profile picture and name, 'David Mitchell', along with navigation links for Dashboard, Users, Policies, Reports, Filtering, Add-ons, Settings, Help, and Roadmap.



Asus ExpertWiFi EBR63

An easily managed all-in-one Wi-Fi 6 router crammed with great security features at an astonishing price

SCORE ★★★★☆

PRICE £125 exc VAT from amazon.co.uk

Asus' ExpertWiFi product family speaks to small businesses and retail outlets requiring a complete network security solution that's affordable and simple to deploy. The EBR63 is a prime example: this deceptively small router teams up dual-band Wi-Fi 6 services with a heap of gateway security measures and delivers them all for only £125.

On the wireless side, the EBR63 has an AX3000 rating derived from claimed speeds of 574Mbps/sec on its 2.4GHz radio and 2,402Mbps/sec on the 5GHz radio, with the latter supporting high-performance 160MHz Wi-Fi 6 channels. However, the EBR63's switch is only endowed with gigabit WAN and LAN ports so you won't see the full performance potential of its Wi-Fi 6 credentials.

A positive takeaway is support for Asus' AiMesh technology so you can use any compatible Asus wireless device to increase wireless coverage with up to 12 mesh nodes. You can also create up to five wireless SSIDs and present custom captive portals to guests and customers.

The EBR63 is a compact plastic unit that can be wall- or ceiling-mounted using the two holes in its rear panel. It also has a flip-out desk stand, but we wouldn't recommend using this in a busy environment as it's quite flimsy and, with the

router only weighing 415g, it could easily get knocked over.

Internet redundancy is present, with the dual WAN feature able to apply failover or load balancing across two internet connections using the WAN port and a LAN port of your choosing. A quick fix if your main internet connection goes down is to connect a mobile to the EBR63's USB-A 3.2 Gen 2 port and use it as an instant internet backup.

Deployment is a breeze using the ExpertWiFi mobile app. With this loaded on an iPad, we connected it to the router's secure default SSID and followed a wizard to activate the device and update its firmware.

Management choices abound. The EBR63 presents a well-designed web interface, which we used to create more wireless, or self-defined, networks. This is nicely handled as you choose from a list that includes employee, portal, guest, scheduled and IoT options, then fill in the fields presented and choose WPA2 or the more secure WPA3 encryption. The "Scenario Explorers" makes this even easier as you choose an environment such as office, coffee shop or home working and it will present you with the most appropriate settings.

Security features are quite remarkable considering the price. The SPI firewall can be customised with up

ABOVE The EBR63 is deceptively small and delivers decent overall speeds



to 128 rules, while the Trend Micro-powered AiProtection Pro service blocks malicious sites, stops infected systems from accessing the network, provides intrusion prevention services (IPS) and generates security assessment reports.

Web content and app filtering can be applied to selected clients where you tick boxes next to any of the four categories, choose a discovered device from the drop-down list and add a new rule. VPN options are outstanding, as Asus supports PPTP, OpenVPN, IPsec and WireGuard VPN servers, while the VPN Fusion feature creates secure connections for devices that can't run VPN client software. In addition, quality of service (QoS)

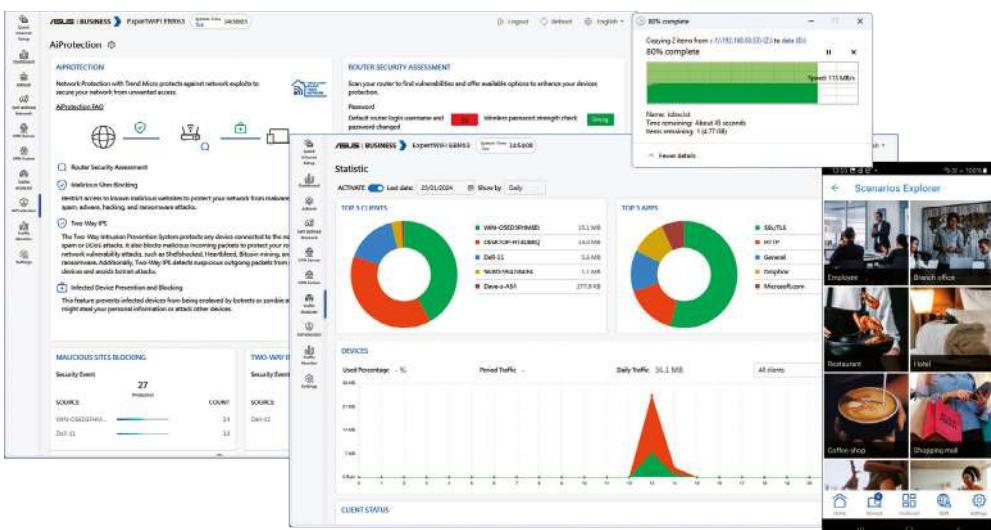
features are handled by Asus' Adaptive QoS, which prioritises traffic from different apps and activities using a customisable list.

Despite only having gigabit ports, the EBR63 delivered respectable speeds in our real-world tests. Using a Dell Windows 11 Pro workstation equipped with a TP-Link Archer TXE75E Wi-Fi 6/6E PCI-E adapter, we saw close-range large file copies between the client and a LAN-connected Windows server return a rock-steady 112MB/sec, dropping to 89MB/sec with the router placed ten metres away in an adjoining room.

The ExpertWiFi EBR63 will appeal to small businesses that want all their network services and security in one, easily-managed device. The gigabit ports do limit wireless performance but overall speeds are impressive nonetheless, and Asus delivers an incredible range of security measures at a very tempting price. **DAVE MITCHELL**

SPECIFICATIONS

AX3000 dual-band 2.4GHz/5GHz 802.11ax • 1.7GHz quad-core CPU • 512MB RAM • 256MB Flash • 4x external aerials • 5x gigabit (WAN, 4x LAN) • USB-A 3.2 Gen 2 • USB-A 2 • external PSU • 226 x 40 x 109mm (WDH excluding aerials) • 415g • 3yr hardware warranty



D-Link DSS-200G-28MP

Best partnered with D-Link's IP cameras, this affordable PoE switch offers a decent power budget

SCORE ★★★★☆

PRICE £356 exc VAT
from broadbandbuyer.com

D-Link is aiming to take surveillance in new directions with its DSS-200G series of Layer 2 switches, which are designed to power the latest IP cameras and provide automated recovery services. This family of four switches is headed up by the 28-port DSS-200G-28MPP, which has a punchy power budget of 518W and offers support for 90W 802.3bt PoE services.

We reviewed the DSS-200G-28MP model, which sits on the rung below and offers a more modest 370W power budget with 30W 803.2at services available across all 24 gigabit ports. Both have four pairs of unpowered copper and fibre dual-personality gigabit ports for uplinks to a network video recorder (NVR) or server.

The switch can power any PoE-compliant device, but D-Link has focused primarily on surveillance usage. It incorporates 6kV surge protection circuitry to shield external cameras against lightning strikes.

One common feature of the DSS-200G series is the block of five DIP switches at the front, which are used to hard-set certain features. The first switch sets an ingress priority



function so packets entering port 1 have the highest priority while those incoming on port 24 have the lowest.

The second switch enables a PoE extend mode on the first eight ports. This overcomes the 100-metre PoE cable length limitation by allowing powered devices (PDs) to be placed up to 250 metres away but, in common with all PoE extenders, it drops speed to 10Mbps/sec.

The third switch activates an isolation function so packets incoming on a "controlled" port will only be forwarded to a designated uplink port. This is a handy security feature; it means that if an IP camera is compromised, the intruder can't gain access to any others attached to the switch.

Next up is D-Link's PD-Alive function, which pings the IP address of a device to check availability and, if it doesn't respond for a specific time, will reset its PoE services and send out notifications, although for traps, only the less secure SNMPv2 is supported. Lastly, the fifth DIP switch enables STP, which uses redundant paths to restore connections due to a link failure.

Two management modes are available, and selecting the standard option from the quick start wizard presents a web interface with access to every switch feature. From here, you can configure all Layer 2 functions, create surveillance and voice VLANs, assign one of three PoE

ABOVE The D-Link DSS-200G-28MP provides a power budget of 370W



"The surveillance mode presents a smart graphical topology view showing all ports and attached devices"

priorities to each port and enable the global ONVIF service so all compliant IP cameras are discovered and placed in a separate VLAN.

The surveillance mode presents a completely different interface with a smart graphical topology view showing all ports and attached devices. After we connected three D-Link PoE IP cameras, they were identified and automatically assigned icons with the correct model photo.

Add non-D-Link cameras and, as long as they're ONVIF-compliant, the switch assigns a generic camera icon but won't identify their make or model. Devices such as our Netgear Wi-Fi 6 APs were simply classed as "other" but, in all cases, PoE services can be manually recycled to force a remote reboot.

The graphical theme continues with the console offering a filtered

view showing only IP cameras along with their IP addresses and power consumption. You can keep a close eye on total power consumption and switch stats from the surveillance overview

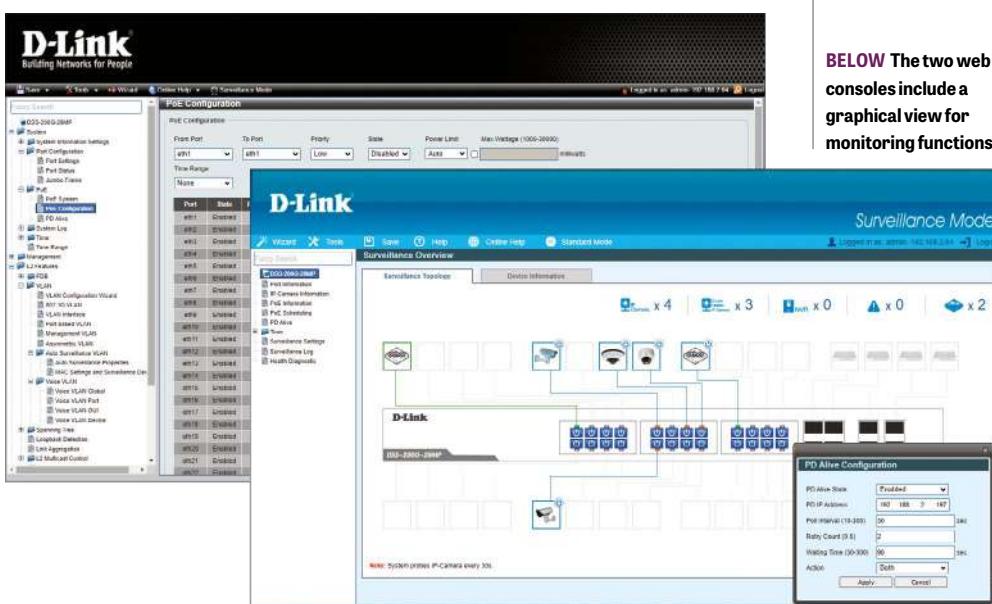
page, set schedules to control when power is provided to selected ports and configure the PD-Alive function on individual ports instead of using the fourth DIP switch.

The web console is mainly concerned with surveillance functions and offers greatly reduced access to switch settings. This isn't a problem, though, as you can swap back to the standard mode if you need to tweak something and then return to surveillance mode.

The DSS-200G-28MP is a worthy contender for business surveillance duties as it offers plenty of smart IP camera management and monitoring features. Value looks good, too, as it includes a generous PoE budget, but you'll need to focus on D-Link's IP cameras to get the best from it. **DAVE MITCHELL**

SPECIFICATIONS

1U rack chassis • 28 x gigabit (24 x copper, 4 x copper/SFP dual personality) • 370W power budget • 802.3at PoE+ on ports 1-24 • 56Gbps/sec backplane capacity • 4.1MB packet buffer • 8K MAC addresses • internal PSU • web browser management • 5yr hardware warranty





How to use VoIP with a distributed workforce

Steve Cassidy explains why businesses need to take VoIP seriously, and tackles some of the big stumbling blocks you might encounter

This year is a big transitional one for voice communications – or at least, for anyone who's been dragging their feet over the switch to shiny new VoIP systems, it should be. In 2025 the UK's old-school 50V bell-ringing telephone network is officially being shut down. This means no more rotary-dial Bakelite phones; soon it's going to be IP or nothing. And in an age when workers are increasingly reliant on domestic telephony to stay connected to the office network, this brings up some definite issues.

■ How smart is your phone?

Once you start shopping around for home VoIP phones you might be surprised to find there's a huge market out there – and it's awash with very similar-looking desktop objects at heavily divergent prices. In fact, a fully featured, top-end, VoIP-capable phone set will cost more than your laptop, while doing a great deal less.

The fact is that the phone business is a lot older than the computer business, and it has quite a different character. It's always been the territory of the contractual sales pitch,

and the proprietary, call-an-engineer style of device support. Even where the systems are themselves eminently fiddle-friendly, you'll still find a lot of sellers aren't exactly bending over backwards to be accommodating.

This is a shame, because many small business-friendly phones (from brands such as Snom or Mitel) can in reality be set up by anyone sitting at home using a basic router to access the host phone system – be it up in the cloud or back at the office behind an old-school VPN and firewall. I've done this myself, passing through a terrible hotch-potch of fibre routers, private-network-ranged internet links and "unsupported" Wi-Fi, which proves these things can be a lot more flexible than the sales pitch and supporting documentation might suggest. But if you'd prefer a cheaper, more lightweight solution, you can opt for...

■ The elusive softphone

I know what you're wondering: "Why is it 'elusive', Steve? I can see loads of softphone apps online, including plenty of free ones." I'm sure you can, but what's elusive is one that's

dependable enough to entrust with your business. Can you tell me the top three softphone apps with household reputations on a par with the big-name phone companies? Of course not: there are none.

That's not to say there's anything fundamentally wrong with the softphone concept. At bottom, it's just a program that does the same job as

"A fully featured, top-end, VoIP-capable phone set will cost more than your laptop, while doing a great deal less"

the firmware inside a physical VoIP handset. Arguably it can do a better job, thanks to the greater screen space available and friendly features such as programmable "soft buttons".

And there are plenty of VoIP specialists who can help you put together a complete communications system without a single physical handset. Some PBX companies even publish their own softphones, for customers to freely download and use on whichever devices they like. These are often streets ahead of public-domain options in terms of ease of setup and tolerance for overlapping VoIP traffic on the same connection,

which can make the systems they represent a no-brainer for a specific homeworker-oriented deployment. It's a business model big enough to have attracted Microsoft – although once you get hold of Lync-compatible hardware it becomes apparent that a lot of the attraction for Microsoft is the potential for customer lock-in, just as it was for the telephone dinosaurs of yesteryear.

While softphones may be ideal if you're starting from scratch, many companies' existing VoIP systems are complicated beasts, in terms of both compatibility and setup. Hacking around trying to make a softphone work with whatever add-on board has been stuffed in your ancient PBX is not an easy or indeed advisable activity.

And it's worth recognising that traditional handsets still have their place. A softphone has to live with other things on the screen, wholly or partially overlapping with it, and while the design may skeuomorphically mimic the functions of a deskphone, the experience of controlling it with a keyboard and mouse is less definite and immediate. So while a softphone may be convenient for someone who spends their day making outgoing calls, for everyday use I've found that people still prefer a real handset.

■ It's Ethernet, but not as we know it

If you're junking an old phone system in order to better support home workers then you can skip this bit – although it may help to explain some of the strange behaviour and options you'll see from time to time. I'm thinking about the way VoIP product designers, especially at the top end of the money, seem to think that voice packets need to be transported as if on a silver platter, carried by a bewigged flunkie, guarded by clattering shiny-helmeted guardsmen.

That may not seem so unreasonable. After all, you can't have a functioning phone system without highly dependable data transmission. But this vision of unimpeded conveyance is fundamentally incompatible with lots of stuff you'd normally build into a LAN, such as packet retry, timeout, collisions and resends. To square the circle a little, VoIP designers use tricks to work around the limitations of your flawed (but perfectly functional) traditional network; for example, some handsets need extra fields adding to your plain vanilla DHCP address-handout servers, with functions such as "here's the PSTN gateway box address" or "your firmware repository share is over here".

This is no problem when your phones are on a separate network segment, and ideally are all in the

same physical building. You may not even realise your VoIP provision has been set up in this way: it takes quite a network aficionado to spot the telltale signs of a paranoid VoIP architecture. However, the minute you want to extend your phone network to remote workers, you have to find some way of presenting these extended parameters over a home router which has – one hopes – been actively configured to discourage tampering.

Then factor in the likelihood that your workers are using a whole range of different ISPs, with different filtering and traffic policies. Some may even be explicitly blocked from non-supplier VoIP by the contract under which the connection was made, because back then your home worker saw no reason to think they might be needing such a thing in the future. Either way, it's far from uncommon to find that not all deployed locations actually work. The cleanest, safest solution is to ensure that the deployment budget has a healthy slice reserved for putting in suitable fibre internet links from a known good ISP. And yes, I do mean providing entire new connections for incompatible home users; there shouldn't be so many of them that this becomes prohibitively expensive.

There are other reasons to be wary when a VoIP design involves some degree of arm's length segregation from your LAN. One is what happens when the poor old customer is transferred from one extension to another. Nominally, you're just routing the call from one node on your managed phone network to another. In practice, transferring the open connection from an internal softphone running on a specially tweaked LAN to a home VoIP handset operating over the public internet is a classic point of failure that puts both wonky networks and cloud-serviced exchanges well and truly to the test. If you've ever been abruptly cut off by a big phone system – and we all have – it's quite likely that multi-layered VoIP services are at the root of the problem.

Let's note, too, that there's something of an inverse relationship between the size of the PBX provider and the broad compatibility of the PBX – or, as it might be, the sort of cloud-based provision that we might call PBXaaS. The big-business behemoths are accustomed to having it all their own way: they're not

interested in slotting into a diverse traffic mix, and want to use their own custom parts and configurations.

Smaller, more responsive companies – 3CX springs to mind as an example – expect their products to live alongside the other packet generators in the LAN, and therefore do rather better when the deployment starts to reach into people's homes and teleworking setups.

■ Various VoIP companies from different corners of the market are focusing on flexible, cloud-resident virtual PBXes

■ Who can you trust?

I've painted quite an unflattering picture of VoIP architects, but if you're inviting one in to look over your existing setup then don't assume they're trying

to pull the wool over your eyes. The process of evaluating VoIP solutions necessarily involves auditing your network and figuring out what it's capable of – and the truth is that quite a lot of our precious business systems are a little bit broken. A degree of re-engineering may be desirable or necessary, and it doesn't have to involve a monstrous re-investment; very few modern network access methods produce genuinely disruptive or incompatible reactions in existing tenancies on your network.

What's more, while there's no escaping the fact that phone salespeople are there to make a sale, they're likely among the very few people you'll meet who have a broad and deep understanding of the horrors that lurk within a regular business network. Listening to their recommendations might be embarrassing, but it might also save you a whole lot of grief later on.

■ Talking in the cloud

While your VoIP transition might be urgent, over a longer term the whole idea of telephony is gradually taking a back seat in business. Videoconferencing software is becoming more commonplace, while evolution in the way we handle sales and support means punters are less likely to stay on hold or tie up workers with long phone calls. And so, various VoIP companies coming from different corners of the market are focusing on lightweight, flexible, cloud-resident virtual PBXes.

The idea has a lot of appeal, especially (but not exclusively) for distributed workforces. The more virtual and geographically diverse your phone-using staff, the more



ABOVE The ways in which businesses are interacting with customers over the phone is changing

sense it makes to use a cloud-based PBX; if you can find a supplier offering better reliability than a dedicated device like the Fritz!box or a modern hybrid internet router, it may be hard to see a reason not to use them.

One potential hitch is that, while a main plank of the general cloud proposition is portability, in this particular area that's not something you can take for granted. For obvious reasons, businesses like to hang on to phone numbers for as long as possible, yet there doesn't seem to be any common standard for throwing those numbers around the many universes of different telcos,

about. The phone salespeople, on the other hand, have been pulling tricks like this since Bill Gates was in knee-socks, so they know how to play the game.

A final sort-of issue with cloud VoIP is that telephony doesn't scale very much. The actual volumes of data involved are minuscule, and capacity requirements don't tend to change significantly at short notice. In other words, one of the greatest strengths of the cloud is somewhat irrelevant here. Businesses aren't interested in "Black Friday offers" and other sideshow inducements to spend; they just want boring, unsexy, unobtrusive

what has been substantially reduced by this unconsidered element of BYOD.

It's notable, in fact, that the VoIP sector as a whole is rather short on softphone apps for smartphones – there is perhaps an assumption that if you're holding a phone that's pre-loaded with your own personal SIM, then that's what you'll use. While consumer messaging systems such as WhatsApp and Discord have no problem running VoIP services on mobile devices, there's some way to go before we get seamless crossover between mobile and corporate IP telephony.

■ Getting it done

If, having read thus far, you're ready to embark on a home-worker VoIP rollout, my last piece of advice is to accept some imperfections. You won't be able to work with every model of router or aged ISP contract out there; as I've suggested above, it's best to put aside some budget to deal with those issues by brute force, replacing incompatible home connections with something more modern and whizzy.

For the sake of employee satisfaction and productivity, it's also a good idea to take note of the large and small volume telephony users in the distributed business. Some senior types might get by with a Bluetooth headset and a softphone app running on their laptops, but the guys who are on the phone most of the day – the ones in roles such as sales, customer service and bill chasing – will want a more box-heavy deployment, with the VoIP phone connected directly to a VPN, ensuring the phone will work no matter the state of their laptop or work-PC-in-the-garage.

Indeed, although it may seem tangential, a VPN setup can be an almost magical solution to many communication woes, making home VoIP phones look, feel and function just like office phones. To get this working you may have to institute a little portfolio of separate VPN IP subnets for each member of staff, and that may seem like a drag – but the alternative of trying to work within a diverse portfolio of domestic internet connections is a good way to turn a three-month project into a nine-month nightmare.

At the end of the day, VoIP is a business tool, and you need to approach providing it at home just as seriously as you would undertake an in-office telephony upgrade. Don't be distracted by cheap and seemingly easy solutions: the goal is to have everything fully managed, with no reason or excuse for calls to be dropped mid-transfer, or for customers to be dropped into "press star to continue" hell. ●

BELOW The boom in videoconferencing has made traditional telephony less critical



hardware vendors, service companies and the like. That spells potential disruption and expense should you wish to switch providers in the future.

Worse, even if you stick with one provider, there's no guarantee that the deal you get from them will be the same from one year to the next. It's a volatile market, compounded by the ongoing effects of the pandemic, and your role in it is primarily as an exploitable asset. You may be loving the ease of configuration of your cloud-based PBX, and its ability to accept connections from diverse ISPs, but all of that pleasure will be neatly balanced by the nonsense you'll go through when the sales rep tries to triple your annual costs, because he thinks you can't move away on a whim.

This is particularly infuriating for IT nerds because, until VoIP came along, telephony contracts weren't something they ever had to think

reliability, all day every day. For some businesses the biggest benefit of the cloud isn't what it actually offers at all, but simply the fact that it gives them somewhere to go – or to threaten to go – when their existing PBX provider screws up.

"If you're ready to embark on a home-worker VoIP rollout, my last piece of advice is to accept some imperfections"

■ Dealing with emergencies

Telephony experts warn that VoIP phone systems don't guarantee reliable access to 999 emergency

services. While this might be true, it's not as big a deal as you might fear. In practice, when disaster strikes, most people don't sit calmly at their desks and fire up the softphone – they grab their mobile, and quite likely make the call while evacuating the building or tending to an injured colleague. The requirement for the company phone system to keep a line open no matter



Cloud for SMBs

Remote services aren't just for blue-chips; Steve Cassidy finds out how smaller businesses can benefit

Aren't cloud services mostly aimed at enterprise-sized businesses?

It's true that the cloud has much to offer big companies. However, part of the cloud promise is about handling unexpected bursts of demand – the classic example being when you get mentioned on the news, and suddenly your website traffic jumps by several orders of magnitude. When that happens, it's the smallest businesses that can benefit most from quickly scalable cloud support.

Our internet service is quite slow – isn't it best for us to rely on it as little as possible?

Bad last-mile internet service is an argument for more cloud, not less. When your servers are mostly working and communicating inside the data centre, it's less necessary to have the fastest possible connection to your own premises. For most SMBs, some sort of hybrid cloud setup often makes sense, so you'll need to "take a view" on exactly what speeds are needed where. Don't accept a slow connection as a fact of life: in this period, and this market, there should be plenty of providers willing to offer you a full fibre upgrade for a reasonable price.

We mostly just run off-the-shelf apps. What exactly could we move to the cloud?

If you use Microsoft Office you've probably been pushed there already. Everyday applications are increasingly embracing cloud provision and licensing, so moving your line-of-business tools in the same direction shouldn't be too much of a shock to the system. Admittedly, not every item of small-business software will happily migrate into the cloud; it can usually be done, but you may need the help of an experienced server-wrangler.

What do we do with our existing on-site servers? Are they just going to go in the bin?

I have encountered a few extreme cloud migrations, where there isn't so much as a wiring diagram left behind to show there was ever a server in the building. But if you want to move cloud platform in the future, it's a lot easier if you still have a local server, where you can clone your databases and confirm that your applications aren't dependent on your provider's specific hypervisor stack. Even if you never really move, this ability is a great safety net – and negotiating tool.

There are so many cloud providers out there. How do we know which is the right fit for our needs?

You're right to be hesitant: not all clouds are created equal. For example, different services might store your cloud data in different countries, which has a significant impact on the legal restrictions you'll be working under. This is where SaaS delivery of just one part of your workflow can be attractive, because you're not betting the whole farm on any single platform. Software trials and sandbox thinking can help you appraise how different platforms fit to your working practices, and work out your priorities in terms of what needs replacing first.

What if our tentative cloud migration goes wrong? Can we migrate back?

If you can't, you were being had right from the kick-off. Post-pandemic, many internet companies seem to act as if they're irreplaceable, and in some cases they may be right. The trick is not to sleepwalk into a state of dependence. Cloud services often sneak their way into organisations, at first for testing and development, then for ad hoc scalability – and before you know it your business is wholly reliant on an always-on, every-job-done-here cloud commitment. Learn to recognise that pattern, and don't get sucked into it until you have your escape plan fully worked out. ●

The four don'ts of SMB cloud

DON'T imagine that moving to the cloud means an immediate 100% lift and shift of every byte in your building. That could be where you end up, but another balance may work better for you. Either way, trying to do too much too quickly accounts for a lot of shame-faced "cloud failure" confessions.

DON'T get bogged down in philosophical debates when application providers switch from direct desktop delivery to cloud-based SaaS platforms. Their business model isn't really your primary concern; stay focused on productivity.

DON'T accept resource limits based on your current usage, or you're liable to find you're using up 100% of your cloud provision on day one. I recommend businesses look for six times as much capacity as they currently occupy; if that makes the deployment untenable, shut it down and move along.

DON'T be surprised by your own uniqueness. The cloud promotes the idea of computing as a commodity, but every business has its own quirks and requirements. Don't be worried about whether you fit the cloud; approach it on your own terms.

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Real world computing

Expert advice from our panel of professionals

JON HONEYBALL

“Don’t think that any Johnny Come Lately can set up an app store. Creating one of these is a big step”

Jon ponders the effectiveness of third-party Apple app stores, has some words of advice for Fairphone and discovers he probably won’t be an astronaut

Apple has announced its proposed changes to the App Store, taking into account the requirements of the EU regulation changes that come into effect in March. They have been released into an iOS beta, and developers now have the documentation.

First, it should be noted that these are comprehensive proposals and that at the time of writing we don’t know whether the EU will accept them. That’s how this stuff works: the EU makes demands, companies try to build to the requirements, and it’s only once it’s up and running that we know whether the EU is satisfied. The battle to see whether what Apple is offering is considered adequate or acceptable will doubtless be accompanied by many lawyers writing invoices using extra-wide calculators. If you want to read the legislation, and who wouldn’t, it’s here: tinyurl.com/355EUregs. Apple’s newly stated rules are laid out at tinyurl.com/355newrules.

The second thing to note is that these changes apply only to the EU, so they won’t happen here in the UK.

So, what is the change? Essentially, the EU has insisted there be alternative ways of getting apps onto the iPhone. It believes this competition between app stores will cut prices for consumers.

Allow me to be blunt: this won’t happen. The simple reality is that most apps are free to the user. If the app requires a subscription, this can be made through a different platform and applied to your iPhone app. Look at Netflix or its equivalents to see how this works at present.

The changes don’t allow for raw side loading, so you can’t take an iOS executable app and just bang it onto your phone. The changes require you to load apps from either the original Apple App Store or from one of the forthcoming third-party stores, so this isn’t open season on loading anything you like onto your phone.

To access an alternative app store, you’ll need to download it – as an app – and only then load apps from the third-party app store. That store can use Apple’s payment processing or its own charging infrastructure, so the easy “double-click to buy” might be present or it might not. And don’t think that any Johnny Come Lately can set up an app store. Creating one of these is a big step, requiring financial indemnities as a starter.

As a user, you might be tempted to download an app from a third-party store when you’ve already downloaded it from the official Apple App Store. The obvious reason would be to benefit from a lower subscription. Apple is insisting that the existing app is deleted, along with its data, and it won’t allow two instances of the same app to be installed with access



Jon is the MD of an IT consultancy that specialises in testing and deploying kit
X @jonhoneyball

“The first thing to realise is that these new rules are entirely optional”

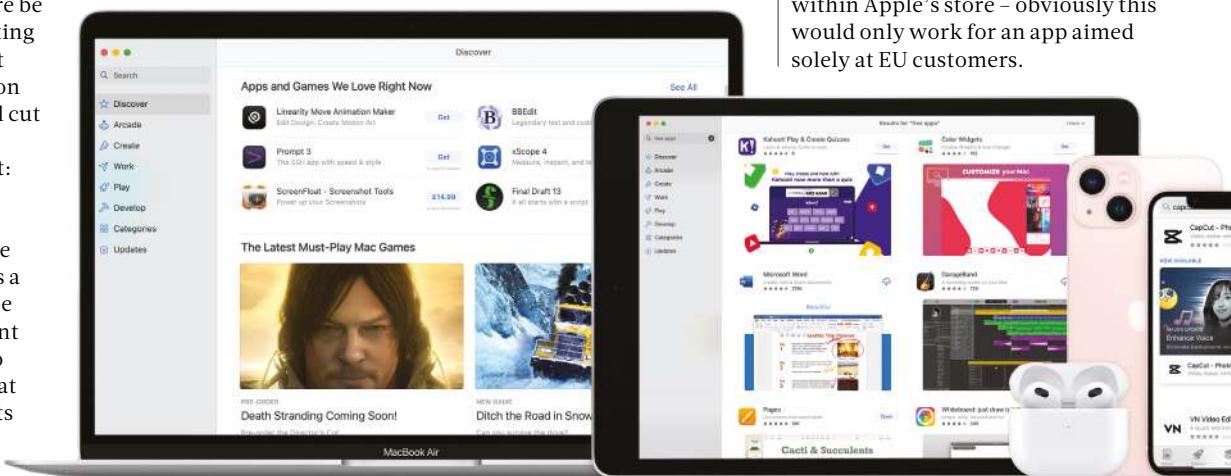
BELOW Currently, users can download apps only from the official App Store

to the same user data. That would, of course, break the sandboxing rules of the operating system.

So what happens for a developer? The first thing to realise is that these new rules are entirely optional. A developer might decide to stay within the current framework and make no changes. This results in no changes to the app, the margin that Apple takes, or the whole support infrastructure (family sharing, refunds, using Apple payment processing and so on).

But the developer might decide to change over to supporting third-party app stores. If so, this is an irrevocable change for the developer account: it can’t go back. With the change to the third-party app store process comes a bunch of new APIs (some 600 of them) and access to use third-party app stores themselves. It’s possible that a big developer might decide to run its own app store, but there are limitations there, too.

Or a developer might do a deal with an app store and host on both the Apple App Store and the third-party one. Or launch an app that can only be purchased through a third-party store, and doesn’t exist at all within Apple’s store – obviously this would only work for an app aimed solely at EU customers.





Jon Honeyball

Opinion on Windows, Apple and everything in between – p110



Lee Grant

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Lawyer Olivia offers legal advice for the tech industry – p116



Davey Winder

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Steve Cassidy

The wider vision on cloud and infrastructure – p120

If the developer is in the Apple App Store, then the current costs apply. There's a 30% commission on sales to Apple in the first year, or 15% if you qualify for the Small Business Program (where your business makes less than \$1 million per year). If the developer is using a third-party store, then the payment commissions are 20% and 13%. If the developer/store uses its own payments system, then Apple's commission drops to 17% and 10%. That 3% differential is probably not an unreasonable cost for credit card processing comparing to other platforms.

However, there is a catch: something called the Core Technology Fee. This only applies to third-party stores. Apple says this is a fee to cover Apple's tools, APIs, technology and so forth. The fee doesn't look too onerous until you look carefully. Apple will allow one million EU downloads in a year for free. Each download above the one million mark will attract a fee of 50 cents per download. This is per user, per app and per year. It is not per device, so one user downloading onto three devices in one year counts as one download.

Note, however, that this is for a download. If you update the app and issue it to your customers, these count as additional downloads, too. So if you have one million user downloads, and then you do an update halfway through the year, it's now two million downloads. And you owe Apple €500,000 (50 cents per download times one million downloads above the one-million free threshold).

Just look at the rate at which apps are updated at present. Often it can be fortnightly. If you're a developer delivering a free app, then you'll need to think very carefully about using a third-party store. Your downloads per year multiplied by the update rate will be your total for the year; go above the magic one-million mark and you'll have to start sending Apple money.

Of course, this doesn't happen on Apple's own App Store. Free apps are free to download, and all you pay to Apple is the developer licence of \$99 per year, which gets you everything. It's hard to imagine developers who make free apps going onto the

third-party store unless they want to cough up large sums of money, or have a way to charge customers enough through the platform to cover the costs. Apple's view is that companies such as Netflix, Google and Microsoft have been getting a free ride on its platform, and if these companies want to charge through the platform, then the free ride is over.

It's hard to know where to stand on this. On the one hand, clearly competition is good. It tends to push prices down. However, Apple still controls the gates for apps on third-party stores: the app must still be submitted to Apple for approval, checking and signing, and then Apple sends it on to the third-party store. So it doesn't free up developers to do something to extend the platform, or create apps that Apple has forbidden.

A good example here will be CarPlay apps, where Apple has a tight control on the type of apps that it will allow to run on a CarPlay interface, and the way these apps interact with users. I don't see Apple allowing a free-for-all for developers to generate a new type of CarPlay app for a third-party app store.

Now to be somewhat controversial. I'm finding it hard to see how these changes benefit me. Most iPhone apps are free. Those that I pay for are usually pretty cheap, certainly compared to apps in the past. We've never had it so good in terms of value for money. I like the unified store

capabilities, single point of payment, and the fact that the store is locked down. If I want raw side loading, I can always pick up one of my Android phones and use that. For me, the walled garden is a benefit, not a hindrance, although I can see how some might have visceral objections to this position.

The EU policy won't be coming to the UK or USA any time soon, although it's possible



ABOVE The EU wants alternatives to Apple's App Store to be made available to users

"I'm finding it hard to see how these changes benefit me. Most iPhone apps are free"

BELOW CapCut is one of the most popular free download apps on the App Store



that legislators will adopt it in the future. I suspect there will be a big element of "watch and see". Given what Apple has proposed and delivered, I can't see a third-party app store tempting developers unless they're huge in scope and scale, and can afford to swallow the Core Technology Fee costs.

Of course, we must still wait to see whether the EU deems this new process to be compliant with the Digital Markets Act. It might decide it isn't, on some small or large grounds. I guess it's unlikely that it will just say, "that will do nicely, Mr Cook". I can certainly see the Core Technology Fee as being against the spirit of the intended outcome of side loading. I can also see Apple's point of view that putting trustable apps into a third-party store isn't without costs. Did I mention that the lawyers will have a field day?

I am also intrigued to see how the availability of these third-party stores is allowed. If I go to Paris for the weekend, do I get access to such third-party stores, simply by virtue of being in France and on a French IP address? Will it be geolocked by what is deemed to be my "home address"? This remains unclear, but time will tell.

It's time to pull up a sofa and make popcorn. This is going to run and run.



Fairphone funk

I like the products from Fairphone: if you want a straightforward, no-nonsense Android phone, then its products are excellent. The Fairphone 5 (see issue 350, p44) might not have the glitz of a Samsung Galaxy S24 (see p72), but its engineering is wholesome, and its unshakable belief in the user being able to take the phone apart and rebuild it with new parts is truly commendable.

So I was intrigued by the company's new headphones, called Fairbuds. Despite their name, these are full-size, over-ear, noise-cancelling headphones in the same style as the Apple AirPods Max, but at around half the cost. And, like their phone brother, the Fairbuds can be fully stripped down and rebuilt with new parts.

Sound quality isn't bad, and I will be covering these headphones in more detail another time. But I was a little annoyed by the app. It's normal for such a phone app to offer custom EQ presets; they're usually named something helpful such as "Rock bass" or "Enhanced voice". But no, those crazy Dutch have chosen terms such as Amsterdam, Tokyo, Boston and Copenhagen. Then there's Studio, where you can fiddle with the EQ yourself.

No, I have no idea why Amsterdam should sound different to Boston. My advice to Fairphone is to stop putting



Tax policy site covering overseas ownership

The people at Tax Policy have built an interactive site showing properties that are owned by overseas entities. Just drop in at tinyurl.com/355tax and have a dig around. The data set is somewhat big, so allow for it to load before giving up, but trust me when I say that this is an excellent resource.



BELOW/RIGHT The Fairbuds can be fully stripped down and rebuilt, but the EQ names are annoying

this nonsense into your app, and tell me what the preset actually does. Otherwise you look a bit silly and annoy the customers. Like me.

In-car camera

Given the bad state of the roads, and often the worse state of other drivers, I decided it was time to fit a dashcam into my ageing Audi A3. A quick internet search landed me on the well-known Nextbase website (nextbase.co.uk), a company based in Wales. It has a new state-of-the-art product out called IQ, available in 1K (1080p), 2K (1440p) and 4K camera versions. It has multiple cameras built in, and supports a second camera unit that you fit to your rear window, which is useful for recording those drivers who try to climb into my boot by tailgating.

The IQ has GSM connectivity and a big range of useful capabilities. It's not cheap at £349 for the 1K model, rising to £449 for the 4K version, and you can then add another £149 for the 2K rear camera. And let's not forget the £9.99 per month for the Protect Plus subscription (there's a lesser Protect option at £6.99 per month).

I decided to have it fitted at my local Halfords as the lad there does lots of camera installs, and knows his onions when it comes to



BELOW The Nextbase IQ is costly and – so far – unimpressive, but it's staying in my car

cable routing. I handled the software setup, firmware updating and so forth.

I've been running it for a month now. The product promises much, and maybe one day it will deliver. But, for the time being, the rear camera is a joke: it mostly doesn't register and is listed as "No Rear Camera". This isn't a wiring issue but due to the firmware being the offspring of Michael Mouse. The main camera should work better, but is a sea of barely beta bugginess. Tap the Protect button on the underside of the main camera to record a snapshot event, and the app says "not present" for all three cameras. Drive down one particular road in Huntingdon and the system registers an "Impact" event. Try to wake the camera and often it simply refuses to connect.

Fortunately, I was recently at CES in Las Vegas, and I happened upon the team on the Nextbase stand. After a frank exchange of views, with me being very polite, they admitted that the rear camera functionality was broken. That the promised Guardian Mode and Roadwatch AI capabilities might arrive some time in the spring. I'm not holding my breath.

This is a textbook example of a product design and release that's out of control. The company started hardware production when the firmware and app infrastructure was clearly struggling to work and missing key capabilities. To say I am unimpressed would be an understatement.

You might wonder why I haven't taken it back for a refund, with the product clearly being unfit for purpose. The answer: I'm intrigued to see how quickly Nextbase can sort out this mess. As a start, it would be good if it admitted to all these issues on its website, and gave a clear public commitment to a timescale for the fixes. At this point, it's way too late to stick your head in the sand and hope no-one notices.

I shall report back in these pages on its progress.

OTP and Authy

My favourite one-time password (OTP, aka two-factor authentication) tool is Authy. It works well on mobile and on desktops. Fit and forget, it replicates the necessary information between my devices. And having Authy on the desktop means I don't have to reach for my phone or dive into the app on my Apple Watch.

So I was somewhat miffed to discover that Authy is withdrawing its desktop apps in August this year (tinyurl.com/355authy). And then downright disgusted when it brought forward the kill date to March. From April, it will only be on mobile devices. I can work my way around this, because the Authy iPhone app will run on M1 or later ARM-based Apples, but I'd rather stick with my normal desktop app, especially since I still do many hours a week on my trusty 2019 Intel Core i9 MacBook Pro.

Maybe I should look at the 2FA facilities within Bitwarden, which looks after my passwords and other secure data. But there's something comfortable about keeping these two functions separate.

Space opportunities

There is a National Careers Website where you can go to find jobs and training opportunities. All of this is good. I was especially tickled by the entry for "Astronaut" (tinyurl.com/355astro). Apparently it might require you to work evenings, weekends and Bank Holidays; no popping home from the moon for a pint and curry in your local with your mates, then. Despite the job being "39 to 41" hours a week, typically.

It says you can "apply for astronaut training with the European Astronaut Corps or with NASA", but don't get too excited. If you want to join NASA then you "must hold US citizenship or US dual-citizenship".

I was further shocked to read that "there's only a small number of astronaut training places available and there's a lot of competition for them". Who knew? And that "you'll need to do rigorous physical and psychological testing as part of the application process so you'll need to maintain excellent health and endurance".

Which seems to rule me out. Damn.

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LEEGRANT

"Many are convinced they've been hacked, scammed or tricked into using rogue software"

As Microsoft launches another homonymic email product, we wonder why OneDrive won't take no for an answer

This month my Real World column will begin with a Real World comment from a Real World customer who dropped into our Real World shop towards the end of 2023. "Why have they made two different apps with the same name?" Before I had a chance to comment on Microsoft's latest attempt to confuse the masses, he chirped back in, "...and these clowns want us to use AI when they're clearly as thick as s**t". Clearly a passionately expressed sentiment, but from his side of the counter, Microsoft had caused mayhem with its rollout of New Outlook. He wasn't alone. We received many calls from panicked people who couldn't understand why their email had become unrecognisable. Most times normality was quickly restored, but once the customers were placated, most of them concurred that Microsoft's latest improvement lacked coherence.

If you don't use Microsoft's email platform, then you may not have encountered New Outlook. It's the long overdue replacement for Windows Mail, which dates from Windows 8 and was built for seamless email synchronicity between Windows PCs and Windows Phones. Although it has been patched into something that is now capable of transmitting email (an intermittent



Lee Grant and his wife have run a repair shop in West Yorkshire for over 20 years

[@userfriendlypc](https://X/@userfriendlypc)

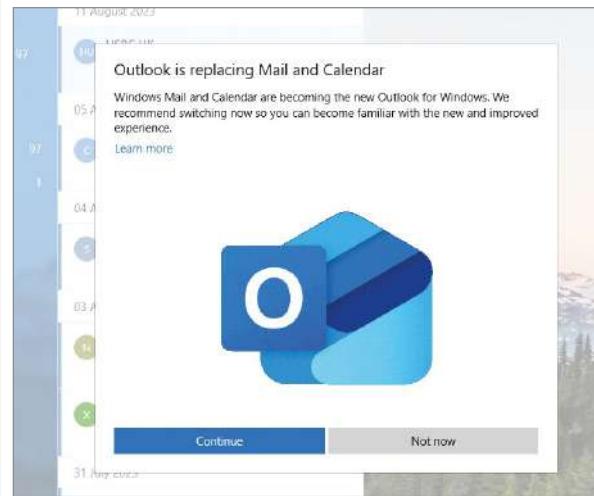
function of early versions), its features languish behind Microsoft's web-offering found at outlook.com.

Four months ago (see issue 351, p112), I mentioned that Outlook for Mac was now a Progressive Web App, or PWA. PWAs tap into the aesthetics and functionality of a web app, delivering them as a machine-based client. They're really a glamorous version of an internet shortcut and a sensible way of working. The theory is that the moment Microsoft brings a new feature to a web app, it will also be available to users who have the PWA installed, therefore reducing the feature imbalance between versions of the same app across different platforms. So why did New Outlook cause a string of complaints?

Officially, New Outlook isn't a finished product, but (hopefully) it should be by the time the 2024 rollout is complete (tinyurl.com/355newout). Most new installations of Windows 11 already include New Outlook as the default mail handler, but users with older installations only discover it when curiosity compels them to hit the "Try New Outlook" button within Windows Mail. Once that occurs, a few warning messages appear – which our exclusive research shows that 100% of complainers don't read – and New Outlook begins to launch.

Or should that be lurch? Once the user clicks the New Outlook button, the Windows Mail splash screen will display (full screen) and then appear to crash, before New Outlook follows. This itself has discombobulated a few clients, but the focus of panic is that New Outlook is visually so dissimilar to Windows Mail, and many are convinced they've been hacked, scammed or tricked into using rogue software.

I realise what I've described may sound like a non-issue. A tech-savvy reader such as yourself is not startled when Microsoft pushes big changes. Heck, I bet you even read and comprehend the warning notices that Microsoft displays before the





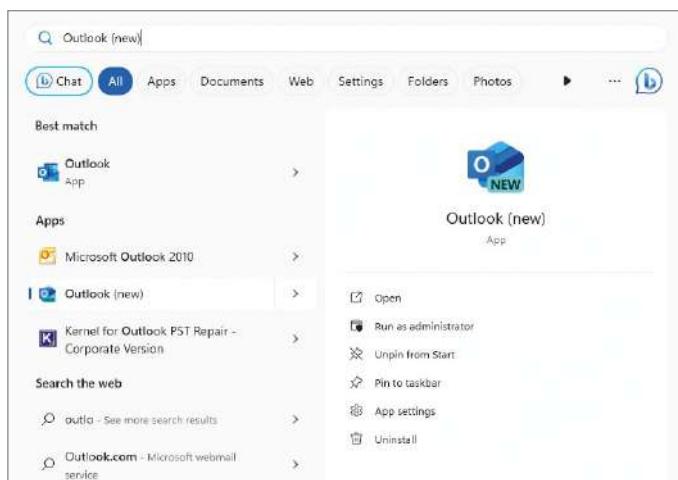
switch happens. Well, let's up the ante and introduce a third version of Outlook into the mix.

Tucked within a Microsoft 365 subscription is the email client, Outlook. For the sake of sanity, I'm going to refer to this as Outlook 365 and, like Windows Mail, this is an app in the traditional sense and Outlook 365 a feature set that lags well behind its online cousin. For some customers, typing "Outlook" into the search will display two instances with slightly different logos. Will the real Microsoft Outlook please stand up?

Take it from me: Outlook 365 customers who unwittingly launch New Outlook and think their email has vanished get very cross.

One presumes that, at some point, New Outlook will lose its newness and require a radical rebrand, but Microsoft has a history of allowing differing apps with the same name to co-exist. There was a time when Windows 10 machines could have two versions of Edge (original and Chromium flavours) and users of Skype (remember that?) and OneNote could also suffer from having "app" and "client" installations whose features were out of balance. Outlook 365 users who haven't ventured into Windows Mail to trigger New Outlook will have also noticed a teasing "Try New Outlook" button. What do you think happens when this is triggered?

Actually, I can't give you a concrete answer as I've seen several scenarios across multiple hardware and software combinations. One possibility is that nothing happens to Outlook 365, but Windows Mail gets upgraded to New Outlook, where they both co-exist and hopefully users can spot the right one. I've also seen machines where triggering "Try New Outlook" in Outlook 365 results in New Outlook becoming the Mail default with Outlook 365 refusing to launch. This is curious as, although both apps are labelled Outlook, their executables differ (Outlook 365 is outlook.exe and New Outlook is olk.exe), so this shouldn't really happen. Denying access to Outlook 365 caused a lot of teeth gnashing, and a simple uninstall of New Outlook brought Outlook 365 back into service. I can't help feeling that this snafu may be a glimpse into the future of Outlook and Office 365.



Many of my customers subscribe to Office 365 Personal or Home to access Word, Excel and PowerPoint. There are a few that use Publisher, although Canva (canva.com) has slashed that user base, while Access and OneNote users are even rarer. Outlook remains the other reason for subscribing to 365, but if the free New Outlook has better features than Outlook 365, then it becomes a tough sell.

Allow me to briefly interrupt my argument to reiterate that New Outlook isn't yet finished and support for POP and PSTs aren't currently as functional as Outlook 365. When it does get there, ask yourself why you'd pay Microsoft £60 a year when it's giving away a better email client and LibreOffice (donate if you can) can mop up the rest? Well, don't look now, but Office 365's MVP is drifting itself into position and it will soon become the reason we're paying subs to Microsoft.

OneDrive to rule them all

Most 365 subscribers don't think about OneDrive, which is odd considering the attractive terabyte of it that can be distributed to each user. Recently, Microsoft has significantly increased its signposting that it wishes Windows users to save files to OneDrive. First was the appearance of the Windows Backup app, which got many of my customers

ABOVE Searching for "Outlook" can throw up two items with different logos

"I can't help feeling that this snafu may be a glimpse into the future of Outlook and Office 365"

BELLOW Windows Backup is a nag and now only works with OneDrive

excited that Microsoft may have updated the Windows 7 backup tool that lingers within Windows 11 (spoiler: it hasn't).

Windows Backup only works with OneDrive, so forget about using it with USB and NAS drives, but it isn't the only ruse to get us all to use OneDrive. If you have the client installed, you may have noticed a pop-up advertising the delights of using OneDrive

as a backup. Unfortunately, this nags, offering a snooze option for "Not now" with only a one-day or 30-day option. There isn't a permanent "go away" button.

One customer, in a moment of weakness, accidentally clicked the "Yes" button, and all seemed well until he opened Outlook 365, triggering a sizeable collection of error messages. In a smart trick, the system had fathomed that Outlook 365 was in play and seamlessly updated Outlook's file locations to reflect their new home within the OneDrive hierarchy. It's refreshing to see joined-up thinking on Microsoft's part but, on this occasion, it was woefully optimistic.

This particular long-standing Outlook 365 customer had a 6GB PST archive, which his machine was now dutifully trying to push uphill towards the cloud. This caused permissions issues as OneDrive's uploader continually told Outlook 365 to keep its hands to itself. A few days later, when the transfer was complete, Outlook worked until the customer modified his archive and everything fell apart as OneDrive struggled to upload the new 6GB PST.

The fix for this should be reasonably straightforward, but it wasn't, which is why the machine in question ended up in the shop. We switched off OneDrive backup,



dragged the files from OneDrive back to the native Documents, Pictures, Desktop, then reconfigured Outlook and removed the OneDrive app. During the uninstallation process, the file system hadn't been modified to reflect the original location of the user data, so any program that tried to gain access using %APPDATA% instead of C:\User\ would look in the wrong place. This is easily fixed if you're confident with poking around the Registry, but if the app can perform the changes one way, it should be able to do it the other way too.

Maybe it's my age, but a lot of technology seems to coerce unwitting users into a "Prisencolinensinainciusol" trap (tinyurl.com/355prise). Like the song, everything sounds right, but on closer scrutiny, it's often garbage. Microsoft is clearly making it harder for the average consumer to avoid its cloud offering with backup, and as Outlook.com already uses OneDrive for mail storage it's natural that New Outlook uses the same methodology (see issue 351, p113, for an example of when OneDrive for mail storage goes wrong).

This all seems like a logical yet persuasive step in migrating the Windows user base from offline to online storage, making the final transition to a consumer-level Windows cloud offering very easy. Is that the long-term plan?

A weighty problem

Over the years, you'll have seen images of the machines that appear in our shop. Some are battered from years of being on the road, their users proud of the cracks and dints in the same way guitarists adore the patina of a worn fretboard. Some machines are fastidiously polished by their owners, looking as immaculate as the day they were unboxed, while a select few look and smell like a family of hamsters are decomposing beneath the CPU cooler.

Then there are those owners that treat their hard-earned hardware like a diamond-encrusted Ferrari, and it arrives in the shop shrouded in towels and bubble wrap, to be unwrapped by a flunkey in white gloves.

Todd wasn't quite this thorough with his expensive Alienware monitor, but when a customer immediately starts telling me how much they paid for it, I know that they're nervous. Also, it's always lovely to hear how much customers spend with large commercial retailers. Please tell all independent traders the exact figure, as we honestly never get



sick to the back teeth of it. Todd also dropped into conversation that he'd taken his monitor to several other repairers, too, and I always find it gratifying to be told that we were last on the list to be thought of. It makes all those late nights truly worthwhile.

Once I'd got over myself, I put Todd's pride and joy on the bench and understood his concerns. The monitor is variation of the AW2721D, a 27in QHD gaming monitor that weighs a tonne, and the issue was what I would categorise as electro-cosmetic. This gaming monitor has LEDs in the rear of the stand, which illuminate in sync with music and games to create a mesmeric visual symphony that is utterly lost on me. The monitor was under a RTB warranty, but because of the weight of the unit (over 10kg), Todd didn't wish to pay a fortune to risk a courier-induced breakage of his prized possession.

The LEDs were driven by contacts at the rear of the panel, roughly where the VESA mount is. When the panel is dropped onto the head of the stand, the connectors meet, and the LEDs should do their thing. Dell has designed zero adjustment into this arrangement, so when the connectors fail to meet, there's nothing to tweak or adjust to assist alignment. If you're bored in the next few days, do a quick web search for this fault on this range of Alienware monitor and you'll see that Todd's case is far from unique and there's considerable frustration among the gamers who have spent a few quid (at other retailers, no doubt) for a nice monitor.

Like all my favourite types of fix, this one was stunningly low tech. The sheer weight of the screen was pulling it away from the connectors in the stand and by supporting the screen, taking the weight, the LEDs lit. Further scrutiny showed



ABOVE A pleasingly low-tech solution to a problem with a heavy gaming display

"I always find it gratifying to be told that we were last on the list to be thought of"

there was around 2mm of movement, so to prevent it from shifting, I took a medium-sized cable tie, snipped off the end and placed what was now just a 2mm high length of tough plastic on the head of the stand. When the screen locked back into place, it now sat 2mm higher, forcing electrical continuity and bringing the spangly LEDs back to life.

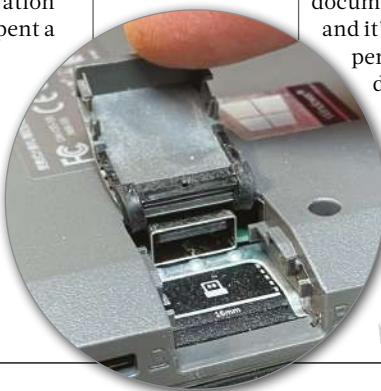
What was under my Christmas flap?

Finally, before we announce the winners of the Christmas quiz (see issue 352, p115), I want to say a sincere thank you to the many entrants for joining in with this nonsense. Our six winners, each receiving an iFixit Minnow toolkit courtesy of the lovely people at the Restart Project (therestartproject.org) are Graeme Couves, Michael Ryding, John Gundry, Ian Powell, Nick Taylor and Alan Ingram. Special congratulations also go to Mrs A Grant of Huddersfield, for working it out before I did.

Our sharp-eyed readers correctly guessed that Lenovo had hidden a USB port under the mystery flap. It's listed in Lenovo's official documentation as "Hidden USB Port" and it's nothing more exciting than a permanent hiding place for USB dongles so they don't get knocked and broken. It's a simple and smart design decision, but not one that I'd seen for many years.

Commissions to those that didn't win this time, but I'm sure we'll do something silly again later in the year.

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BELLOW In a flap: the hidden USB port that was the answer to the Christmas quiz



OLIVIA WHITCROFT

“When someone asks me to prepare a privacy notice, I find it hard to meet their expectations”

If you haven’t updated your privacy notice for a while, now is an excellent time – and if you’re doing it as a box-ticking exercise, you’re doing it wrong

The most common request for data protection services that I receive is to prepare a privacy notice. Actually, a lot of people ask for a privacy *policy*, to which I reply that I can assist with their privacy *notice*. Then they say “policy”, and I say “notice”, and we go back and forth for a bit before I write “privacy notice” in my laminated engagement letter, and then that’s settled.

A privacy notice is an important step towards transparency in how you handle personal data. But there’s a popular belief that if you put a hastily typed-out privacy notice on your website, then that’s data protection done and dusted. As I touched on in my article six months ago (see issue 349, p116), this overlooks all the behind-the-scenes assessments that are needed to feed into the content of the notice.

So when someone asks me to prepare a privacy *policy* notice, I find it hard to meet their expectations. They’re assuming I will grab a template, press a few buttons, and generate a perfectly crafted notice within a matter of moments. I, on the other hand, envisage spending a few days understanding how the business uses data and helping to assess relevant risk and compliance matters, before putting pen to paper to draft a new bespoke notice. This gulf between our perspectives can cause disappointment for both of us.

Unlawful use of data

Article 5 of the UK GDPR sets out seven principles that organisations must follow in their use of personal data. The first principle is “lawfulness, fairness and transparency”. If you write that you are doing something in a privacy notice, you may have started to tick off one-third of this principle



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X @ObepOlivia

“The gulf between our perspectives can cause disappointment for both of us”

in pursuit of transparency. So you still have 6.6666 (etc) principles to look at.

A business recently asked me for help in writing a section in its privacy notice about use of CCTV. I replied that I could do this, but that didn’t mean it would be lawful. The business decided not to engage me, and who can blame it? Unlawful advice is probably not what you’re looking for in a lawyer.

What I had intended to communicate was that by letting people know that you use CCTV, doesn’t necessarily mean that your use of CCTV meets all the principles of data protection. More work is needed to assess this. The first step is to understand why the CCTV system is being used, where it may be placed, when it may be active, what types of data it collects, where it stores recordings and for how long. Then you can think more about the principles: checking there is a legitimate purpose (for example, to detect and respond to unlawful activities), identifying a lawful basis (for example, a company’s legitimate interests in preventing or investigating illegal activities, or a public authority carrying out a public task), minimising data collection and use (for example, using the cameras only in particular areas at particular

times, capturing images but not audio), keeping records secure (for example, encrypting recordings), and setting retention periods (for example, deleting recordings after 30 days).

Carrying out a data protection impact assessment for high-risk scenarios, or other risk and compliance assessment, can assist in mapping out how the system will be used and identifying the required measures. These can address the data protection principles, and the related rights of individuals, such as how to give access to relevant recordings if an individual requests a copy of their personal data.

Once all these matters have been assessed, the outcomes can be reflected within the privacy notice (and other communications, as I raise below).

If I could leap back in time, maybe this would have been a better way to have phrased my response to the business’ query.

Transparency

The purpose of the transparency requirement is to provide useful information, so people can understand how you use their data and are able to exercise their rights effectively. Too often, preparing a privacy notice is treated more as a box-ticking exercise; something that broadly refers to the required elements, without giving much thought to how informative the notice actually is. Let’s consider a couple of classic examples.

■ **Meaningless data retention wording:** “We retain your data for as long as we need it.”

■ **Requiring the reader to obtain a legal qualification to decipher a**



RIGHT CCTV cameras raise a number of data protection issues

description of international data transfers: “We may transfer your data outside the UK and the EEA, to countries where the UK has not deemed the laws to provide adequate protection for your personal data in accordance with Article 45 UK GDPR. We implement appropriate safeguards in accordance with Article 46 UK GDPR in relation to such transfers.”

It isn’t enough to cover a particular topic without also thinking about your form of words, and whether the individuals it’s aimed at will gain meaning from those words. Words are also not the only option. Other methods, such as icons, pictures and videos, may make the information easier to take in, particularly for certain audiences, such as children. A layered approach, with digestible summaries and links to more detail, can also assist.

A client was recently reviewing its privacy notice and wanted to add some wording about sharing data with companies conducting data analysis on its behalf. Two pieces of information that must be provided to individuals are the purposes for which data is used and the “recipients or categories of recipients” of personal data, meaning who the data is shared with. It may be tempting to consider these boxes ticked with something like this: “We may share your data with other companies for analysis purposes.” There are perceived benefits of the broad and generic phrasing, as the wording could capture different types of sharing and analysis in future, and not just the ones that are envisaged now.

But is this wording actually helpful for the reader? If it were addressed to me, I’m not much further forward in understanding what is going on than if you hadn’t told me anything at all. What data is being shared? What does “analysis” mean? Who are these other companies? What will they do with the outputs?

How about this: “We may share information about the services you have purchased, together with your age and location, with [named company] or [UK companies providing data analytics services]. They identify trends in our customer base to assist us in improving our services and marketing strategies. These companies hold your data on our behalf, meaning that we remain responsible for how they use your data. We pseudonymise the information before sending it to these companies, so that they don’t

know who you are when conducting the analysis.”

This wording is tailored to the particular scenario, so it gives me more understanding of the specific data-sharing activities. And I know that the original company is still responsible for use of my data, so I can contact it with queries, or if I want to exercise my rights (such as, where relevant, rights to object or to withdraw consents I have given). If different activities are planned in future, the notice can be updated at that stage.

Is having a privacy notice enough?

Information generally needs to be provided in an easily accessible form at the time the data is collected. As well as thinking about how your notice is drafted, you must also consider how and when individuals will be presented with it. Will they actually see and read it? Having a privacy notice nestled deep within your website is ineffective if no-one ever looks there.

A related issue is whether your privacy notice alone is the most effective way to communicate all the information. However brilliantly drafted and presented, most people (alas) don’t spend their days excitedly reading every privacy notice that comes their way. The law requires the information to be provided, but not a privacy notice as such. In context, other methods of communication may be preferable for transparency.

Let’s take the CCTV example again. The business had decided to install a CCTV system within the reception area of its offices. I may be a visitor to the office, having had no previous relationship with the company. The business needs to inform me that it is capturing images of me at the time the system records them. Am I expected to go to its website and read the privacy notice before crossing the threshold? Or will there be someone at the door handing out paper copies as I enter? In this context, it’s common to have prominent signs on the wall that inform me that CCTV is being used in the room, and providing contact details for who is in charge. As an example, the UK Information

The screenshot shows the ICO (Information Commissioner's Office) Privacy notice page. At the top, it says "The ICO exists to empower you through information." Below the header are navigation links: Home, For the public, For organisations, Make a complaint, Action we've taken, and About the ICO. To the right are "Share" and "Download options" buttons. The main content area is titled "ICO Privacy notice". On the left is a sidebar with a search bar and a list of links: 1. General information, Changes to this privacy notice, Controller's contact details, Data Protection Officer's contact details, How do we get information?, Your data protection rights, Request a service adjustment, Sharing your information, Links to other websites, and Your right to complain. To the right of the sidebar is a cartoon illustration of two people interacting with a computer screen displaying a video player icon.

ABOVE Make sure your privacy notice isn't hidden away deep within your website

Commissioner's Office suggests: “Images are being monitored and recorded for the purposes of crime prevention and public safety. The system is controlled by XXXXX. For more information, visit our website at (web address) or call 01234 567890.”

“Reading through my article now, it’s a wonder I have any clients”

These “just-in-time” notifications are a common way to assist with transparency. They inform someone about a particular use of their data at the time it is relevant, rather than expecting them to dig around in a lengthy privacy notice, or to remember what was said in a notice given to them a long time ago. For example, if you’re collecting information in an online form about someone’s age, you could have a pop-up next to this field, which says why you need this information. Or, if someone hasn’t used a feature on your platform before and one day decides to activate it, consider a short notice that explains how this feature impacts use of their data.

And how about talking to someone out loud? You could let them know that you’re recording a meeting and why, or explain that you’re making a note of their name and email address to contact them with any queries arising from a discussion.

No more disappointment

Reading through my article now, it’s a wonder I have any clients, when I criticise their terminology, offer them unlawful advice and cause disappointment with what I deliver. Perhaps the guidance I have provided on privacy notices may also be the way forward for my future responses to queries: properly thought through, clearly worded and communicated in an effective way. Something for me to consider, anyway.

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DAVEY WINDER

"I am now perfectly situated to moan about Apple stuff as much as I do Windows or Android"

If you're an Apple user and think you're safe from attack, then think again. But some common sense, and an app or two, will build some useful barriers

My name is Davey Winder and I'm an Appleholic. There, I've said it. For the first time in my 35-plus years as a technology writer, I am now primarily using Apple technology. I do still own a Windows machine, a beast of an Alienware gaming laptop that I now use almost entirely for doing what it was built to do. Apart from that, and the Samsung Galaxy Z Flip5 foldable that I use as my secondary smartphone because it's so pocketable, my daily drivers are all from the Cupertino fruiters.

I switched from Android to iOS some years back now, having become too frustrated with the fractured Android ecosystem and the delays to security updates that brought with it. Since then, I have upgraded my iPhone every year to the latest Pro or Pro Max version as they are released. I also switched to an Apple Watch from my Samsung Galaxy Watch, which I loved but was pants when coupled to an iPhone, and I'm currently using the first Ultra as the second edition didn't add any real value to me. Then, a couple of years ago, I dove in and added an iPad Pro, the 12.9in M2 processor version of course, which was great alongside the iPhone. Mostly.

At the start of last year, I underwent surgery to have a knee replaced because I'm an old man. Unfortunately, while the surgery itself was a success it brought with it a complication that impacts me hugely to this day. It triggered something called Complex Regional Pain Syndrome (CRPS), officially the most painful incurable condition according to the McGill Pain Scale. To cut a long story short, and to save you from the gory details, this has led to a complete shake-up to my workflow:



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X @happygeek

everything from my working environment to the kit that I use and the hours I can manage has changed.

I am fortunate enough both to be my own boss and to be able to work from a home office. I am unfortunate enough to no longer be able to use the large office that was once home to a boy who has long since become a man and fled to pastures new. The nature of my pain is such that I can't work sitting (or standing) at a desk for longer than five minutes. Indeed, since the start of April 2023, I have been working from my bed. I prop myself up, have a large folding desk in front of me and, on a good day, can now mostly manage 30 minutes at a time, alternating with 30-minute breaks. I sometimes work using a smaller desk tray from the sofa downstairs, leg propped up on a huge foam wedge.

The common denominator is the iPad Pro with Magic Keyboard, which became my daily work machine for grinding out analyst reports and articles for publication



RIGHT The iPad Pro with Magic Keyboard is now my daily work machine

alike. The trouble was that I eventually found this a little too clunky, for want of a better word, with too many steps in my workflow when it came to research-writing-editing-sharing/publication. Maybe I was using the wrong apps, maybe the apps for the iPad were just not powerful enough, maybe shmaybe – it wasn't working at full capacity and that meant neither was I.

Embracing the Apple ecosystem

Luckily, Apple was about to announce a new MacBook Pro. Never a good sign for the bank balance, especially as the nice black one I chose came with the new M3 Pro chipset and lots of RAM. All of a sudden, the entire Apple ecosystem thing made sense and my workflow benefited accordingly.

Of course, I can't fit my 49in 5K Dell ultrawide monitor on a lap desk, which sucks. So I bought a set of relatively cheap 1,920 x 1,080 USB-C clip-on monitors that turn the MacBook Pro into a triple-screen beast. Actually, make that a quad-screen beast, as I also have my iPad Pro attached to a desk-extending arm that allows it to sit above the MacBook screen. Continuity mode works like a charm with the iPad and iPhone; a little configuring and the side monitors also meet my expectations.

This means I am now perfectly situated to moan about Apple stuff as much as I do Windows or Android. I am not a "fanboy" of any platform; if it stinks, I call it out. Talking of which, my first frustration was with the Apple MagSafe charging connector for the MacBook. Pulling it out felt like it was being primed to break sooner rather than later. So, thanks to former RWC boffin Paul Ockenden, I can now reveal I am an idiot: don't pull the thing but just tip the magnetic end up and it releases easily and safely. Please tell me I'm not the only person to have not realised this. Oh, right...

Apple security and privacy matters

I'm happy to say there have been no such frustrations yet from the security and privacy side of the everyday user fence. I'm a "just say no" kind of a person when it comes to app permissions; I decline all such

pop-ups for newly installed apps as a matter of habit. If that app really needs what it's asking for, then it's going to break, likely ask for it again, and I can rethink my choices at this point by balancing how much I need the application and how much of my privacy it will impact. I've found that this experience has been much more pleasing on the MacBook than it was on my Windows machine, with it being very easy both to deny stuff immediately and then enable it later.

I hardly use Chrome on my MacBook, either, with Safari being both the obvious default choice and the go-to for privacy and security-focused users. I've found myself using Brave and Firefox less since I switched to macOS, too. Your mileage may vary, but for the average user, Safari will be private enough. Especially if you subscribe to iCloud+, which brings you Private relay browsing in Safari; this routes all your activity through an encrypted Apple proxy server. Think of it as being a VPN-lite in that it won't enable you to evade region locks on streaming services, for example, but it will prevent your ISP from having visibility over your browsing.

For my fellow newcomers to the MacBook Pro, there's a useful official quick-and-dirty guide to configurable security and privacy settings for macOS Sonoma 14 online at tinyurl.com/355support.

Don't fall for the old "no need for security on a Mac" schtick that some cult members still think is relevant in 2024. It isn't. Mac malware exists. Mac threats exist. Mac zero-day malware exists. There isn't as much of it as there is for Windows, and you certainly don't hear as much about it on the newsfeeds, but there's a simple reason for that: Windows has the most users and is a more valuable target.

Actually, it isn't so simple any more, as threat actors are waking up to the fact that while macOS represents a smaller attack surface, the lack of security awareness among many of the users makes for a ripe target. This isn't the same as saying you need to invest in macOS antivirus applications (XProtect is built in and good enough for most folk) on the one hand or shouldn't worry about getting hacked on the other. As with all things in life, so with secure thinking: getting the balance right is key. You don't need to lock your Mac down tight with every five-star

RIGHT Try Little Snitch for monitoring outbound network traffic

The screenshot shows a MacBook Pro with its screen displaying the 'macOS User Guide' for 'macOS Sonoma 14'. The guide is titled 'Change Privacy & Security settings on Mac'. It includes a table of contents and a section on location services. Below the screen, two windows are visible: Setapp and Little Snitch.

ABOVE Check your macOS Sonoma security and privacy options

BETWEEN Setapp is a great Mac app money-saver

security app that you can find; you do need to be aware of the risks, which are pretty much the same as any Windows user faces.

Download your applications from the official App Store and you can't go far wrong, or even from other verified stores such as the Setapp one (setapp.com). Incidentally, Setapp is well worth checking out. There are loads of well-known apps available but with the benefit of one solitary Setapp subscription of \$135 per year, which sounds a lot but isn't if you use a handful of powerful apps.

If you do download software outside of the official App Store, then Gatekeeper will scan any app to ensure it is verified by Apple and free of malicious code. It isn't foolproof, of course, but between XProtect, Gatekeeper and a suitable dose of common sense, your Mac is fairly safe as such things go. If you feel you want to add more armour to the defences, then Intego and Bitdefender are both solid choices for security applications.

That common sense I speak of includes ensuring that you have your automatic update configuration enabled for Apple software updates. This doesn't always necessitate a system restart either, now that Apple has instant security response updates and rapid security responses.

The MacBook also comes with a firewall, which is limited to protecting applications and services from accepting incoming connections. I mean, that's fine as far as it goes, but I would prefer it to go further and protect against those things making outbound connections. The aforementioned Intego security app comes with a firewall, NetBarrier, that allows the blocking of outbound connections.

Personally, though, I rather like a nifty app called Little Snitch (obdev.at). At €48 for a single licence it isn't cheap, but it's an excellent tool for monitoring and controlling outbound network connections with one click.

There's much more to say about macOS Sonoma, the MacBook Pro and M3 silicon, as well as the Apple ecosystem in general, but I'll



Continued from previous page

save that for future columns. Don't worry, though; this isn't going to turn into a Mac-only zone. My coverage of all things security and privacy-related will continue to be as cross-platform as ever, and Windows users will most certainly not feel abandoned here!

Get over it? Nah!

Was it really 25 years ago now that Scott McNealy, Sun Microsystems CEO at the time, told journalists that there is zero privacy and people should just get over it? If my memory serves, this was at the launch of something called Jini, which was wrapped up with the Java programming language. At the time there was outrage, followed over the years by a begrudging acceptance that maybe McNealy was right after all, especially where the internet was involved. However, we have come full circle on the privacy debate in recent years, and getting over it is firmly off the agenda.

I mention this as privacy-centric web browsers have been a thing for a while, with the likes of Brave and Firefox leading the way across all platforms, plus Safari for Apple fans, of course. Even those browsers that are not, perhaps, front and centre when thinking of privacy embrace private browsing components, such as Chrome's Incognito mode. How private is Incognito, though? Good question, and the answer isn't really that surprising: not as private as you might think.

At the time of writing, a pre-release version of the browser has an updated notification regarding Incognito mode that confirms as much. The notification states that "others who use this device won't see your activity, so you can browse more privately, this won't change how data is collected by websites you visit and the services they use, including Google". This comes off the back of a lawsuit about Google still tracking Incognito users, and I assume will be in a release version of the Chrome browser soon enough. Not quite the zero privacy of which McNealy spoke, but I'd suggest anyone using Chrome and complaining about privacy matters really should get over it. That, or start using another browser.

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STEVE CASSIDY

"Everybody is on the case of finding better ways to store energy"

Power generation, delivery and storage are three big challenges of our time, and it turns out that Azure and AI hold some of the answers

I don't want you to think I'm obsessed by batteries; it's just a busy time in the whole power generation and delivery field, as some futurologists start talking about battery-powered airliners, cargo ships, forklift trucks and so on. We in the IT sector have a head start. Our experience of the behaviour and risks of rechargeables is a premonition of the state of society for years to come. The whole design of a power grid that allows for home generation and EV charging is dependent on good battery design and placement. We've already seen the comic videos of laptops on fire morph into not at all amusing videos of scooters being the seed of much more catastrophic incidents.

Everybody is on the case of finding better ways to store energy. If you can figure out how to use other elements to hold and release charge, the world will beat a path to your door. There has been no shortage of hopefu... so far: hydrogen/oxygen fuel cells looked hot for a while, until it became clear how hard it was to keep them heated to the 400°C at which they worked most efficiently. Lots of other material combinations have had their turn in the spotlight, without delivering the game-changing stamina and capacity we seem to need. Zinc-air laptop batteries, anyone?

No, I thought not.

And this field is no different when it comes to cranks. Articles about perpetual motion machines and "zero-point energy" remind me of ads for those replacement laptop batteries we learned not to buy – you know, the ones with a tiny cell in one corner and a load of lead scattered through the rest of the casing to make it feel kosher. Unfortunately, the vocabulary of fakers and scammers is hard to distinguish from that of people making a genuine breakthrough.



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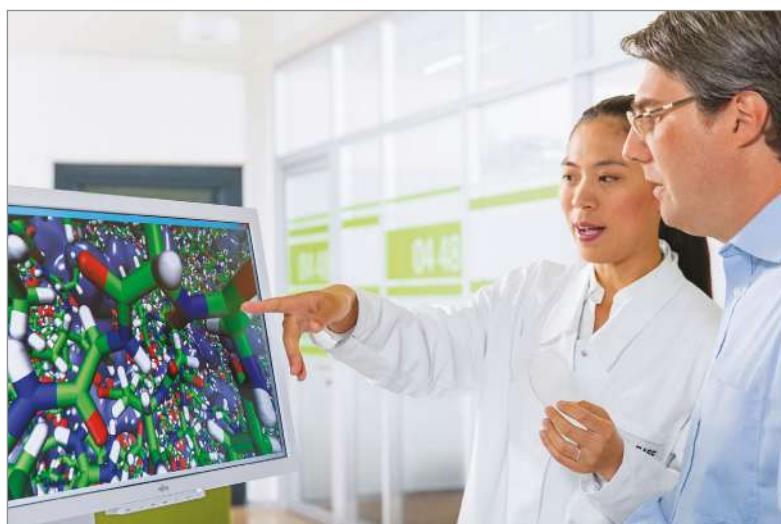
This is why I've been looking at a bold claim made by a research team from our friends at Microsoft (tinyurl.com/355azure1). These guys have used a sizeable proportion of the Azure cloud to remodel the humble lithium-ion rechargeable cell. They found promising-looking configurations of the elements in the cell that could allow it to store several times as many watts as a classical tube-of-porridge rechargeable. Given the level of importance the battery is assuming in all parts of society, this seems to be worth a mention of itself.

I can hear the sceptical voices, though. What's the relevance here? How does this change the bottom line in my business? To answer that, we must look under the hood of both the problem and of Azure itself.

Materials science is behind a lot of everyday life in the 2020s already. White LEDs? Materials science. High-capacity hard disks? Materials science. High-speed, pure fibre-optic glass? You can guess. Lift the lid on almost anything solid-state, smart or compute-capable and you'll find the hand of materials science at work.

This is the field of discovering new combinations of basic building blocks, ways that otherwise unremarkable elements might be combined into far

BELOW Scientists are at the forefront of almost all new tech in the 2020s



more useful materials. Perhaps the simplest example is mercury amalgam tooth fillings, those off-silver blobs that are slightly flexible, slightly hard and sit in our mouths for decades without causing any of the harm we might expect from the mercury they contain.

Left as a purified substance, mercury would never enter anyone's thinking as a suitable contribution to the recipe for a filling. But when combined with an unlikely partner courtesy of some Elizabethan materials science research, it works. My partner just said, "oh, like crocodile poo in Egyptian lipstick", which goes to show that experimenting with ingredients is as old as history itself. While not necessarily inspiring ultimate confidence in the consumer.

Pure materials science involves an almost impossibly widespread net of investigations. Is the combination flammable, explosive, corrosive, poisonous to humans, rats, wheat, bananas...? In the case of the Microsoft contribution to a better battery, the vast majority of material properties and indeed materials have been left out of the equation: the question was, given existing battery factories, what could be done to improve the capacity of the products they are making?

If you're thinking this simplifies the process of identifying suitable materials, you'd be right. Microsoft reports that the project began with 32 million candidate materials (chemistry fans, the researchers wanted to find a solid-state electrolyte), then started throwing out candidates in a series of refining steps largely untouched by human hand. Going from 32 million to 500,000 and then 800, finishing with a shortlist of 23 all "in silico" is a useful time-saving in anybody's terms.

But then the small print starts to intrude. Initially, I thought this was a story about the massive brute-force punch available by using those famously scalable cloud technologies. Microsoft's account lays more emphasis on machine learning and how AI helps to shorten research and decision times.

I think this is a false conclusion. I understand the limitless nature of the compute resource needed when tackling a 32-million-entry database of anything, never mind when it's as complex and data-heavy as a materials science selection sweep, but the key time-saver is announced to be the substitution of an ML outcome in place of a quantum chemistry simulation. Call me peculiar (hush at the back), but that seems to me like taking out a game of chess and

replacing it with a roulette wheel.

Of course, this type of substitution might not make a practical difference when the final stage of the materials selection process features pestles, mortars, blast furnaces and hammers. Reassuringly physical confirmation of the suggestions of the machine, even if the eventual process served up five known existing candidate chemicals and a shortlist of 23

finalists for the best new discovery. Although, with a somewhat puzzling lack of detail, Microsoft says that this part of the process required "only" 80 hours. Of course, I'm itching to find out whether those 80 hours were constrained by the Azure budget to be on one, ten or 1,000 Azure VMs, and what the spec of those VMs might have been – both within the virtuality, and in terms of underlying physical hosts.

Then we come to the difficult and persistent issue of intellectual property. The report mentions the advantage Azure has because it possesses ML-trained AIs with specific chemical experience. The more runs an ML AI makes, the more experience it accumulates, which improves the accuracy of selections and predictions. But what you are going to be asked to pay for that privilege remains the unanswered question. Eventually, species of ML AIs will be like pooches of valuable pedigree, guaranteed to give you what you want based on exposure to multitudes of older projects, most of which were sponsored by your competitors, not you. Just the sort of issue to appeal to the kind of lawyer fascinated by the

ABOVE Microsoft is using Azure to help discover new materials

"Eventually, species of ML AIs will be like pooches of valuable pedigree"

BELLOW The Microsoft project is aiming to improve battery tech



incredible claims made on behalf of AIs by thoroughly human authors.

The takeaway here is disproportionately straightforward. Brute-force computing has limits, even in the midst of the biggest and the best compute cluster on the planet, and software development has workarounds that only the craftiest and most human of developers will have the breadth of regard to employ. In making best use of modern cloud and AI, you need to engage with some of the oldest problems in computing, revisiting times when code was written a byte at a time in search of absolute performance. You're now drowning in data both fake and real, and need the firepower to help with eliminating the stuff you don't want messing up your results.

In many ways, AI has taken us backwards rather than forwards. The main reliance inside this gargantuan compute architecture is on an ML pseudo-neuron network of only a few hundred connections, standing in for a much more compute-intense and pointlessly super-accurate representation of a process with relatively few outcomes.

So, when you look at a proposal heavily salted with promises about AI making the difference, ask yourself: who pays for the benefit that brings, and who gains from the processes you put it through? Or is it not AI at all, just a mix of brute force elastic computing, proprietary hardware and marketing?

The post-quantum world

No, the Post-Quantum World isn't the working title of the next *Iron Man* movie. It's what we're entering into, according to a sober assessment by security giant Thales into what companies need to think about – and of course, buy – to continue functioning in an environment in



which quantum computing is easily available for good or bad purposes.

It's a world, Thales explains at tinyurl.com/355thales, in which all and any cryptographic methods in common use are vulnerable to brute-force cracking by giving the problem to a quantum processor. I like to think of this idea as multiverse computing, or a cloud that stretches out in nine or more dimensions.

Is that fancy poetic imagery? Not a bit of it. If you read the original scientific explanations of the basis of quantum computing, then it starts to sound as though 1970s sci-fi author Larry Niven was on to something. He suggested that foggy nights were spooky because the fog was nucleating around weak points in the intra-universal manifold, causing people to disappear without trace because they had stepped "between worlds".

Quantum computing really does propose that there are millions of other "yous", all with their own version of your QC processor, and that the millions of universes they inhabit are so similar to ours that when you run your QC job, so do they. There are both philosophical and physical problems with this as an idea, but the early assessment is that millions of quantum others will deliver results that far outperform the preceding estimates on time-to-decrypt for most commonly used crypto systems in use today. What can we do as businesspeople, asks Thales, to combat the prospect of our finest encrypted resources being trivially decrypted?

I've put this subject together with the Microsoft materials science project because I think it illuminates a similar heavily overlapping field of modern use of computers: the part where re-evaluation seems to be forbidden. You're not allowed to change your rules or business procedures to remove the risk, because that would mean people would stop making such widespread use of encrypted traffic and documents.

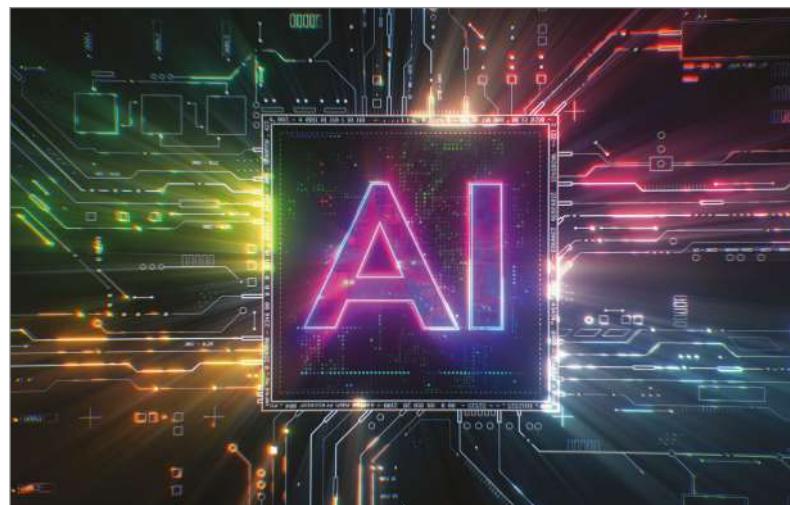
In practical terms, being told that you ought to be using "higher levels" of encryption are entirely missing the point. It's not up to the end-user business to determine the particular algorithm or class of encryption used in a conversation with a particular service; it's up to the service provider to declare what it will support and

what it won't. If you find your Council Tax payment processor to be somewhat lacking in good security, then you can't demand it shifts to a 4,096-bit public/private key exchange service, especially for you. Necessarily, the security of service providers moves rather slowly.

So slowly, in fact, that if I take a quick straw poll of my current crop of bothersome hackers, I don't find any of them threatening to unleash trans-dimensional quantum computing resources to turn my customer records to dust with a snap of their fingers. I find a highly suspicious shadow courier company, which tells me I have an unclaimed delivery each time I order items from overseas, and a few almost comically pathetic attempts at fake identities on Facebook. No quantum mechanical shenanigans here. Meanwhile a few friends in the North London music scene see the occasional clever attempt at capturing their online identities, to sell ludicrous trash to their presumed zombie-like followers. Again, no big Q in evidence.

As with the verdict on Microsoft's truly gargantuan data-mining exercise in search of a better battery, my verdict on the perils of a post-quantum world is similarly relaxed. Of course, you can expect your technophile CEO to come galloping in all breathless over these megascale modelling or sleight-of-hand decryptions using parallel universes, but the outcome of each story is that the major benefit comes from the least expensive part of the kit list.

Quantum computing is a long way from being production-ready, but you could still set up a QC assembly in your basement. Training a machine-learning AI is an even lower investment – you



ABOVE AI: almost certainly not an immediate threat to your security

"Some things you can't sex up with random references to 'quantum' or 'AI'"

BELLOW Quantum processors are also unlikely to be used in hacking attacks soon

can raise an "innocent" ML creature on your reasonably chunky laptop, feeding it some virtual finger-food to start the learning process. Neither AI nor QC demand a multi-million dollar investment to demonstrate a bit of usefulness or constructive learning.

However, that's not to say that the Big Computing efforts are always a dog and pony show, a way of justifying a high access fee to a low-investment compute platform. There's no simple party trick to sorting through a 33-million-record database in search of a better electric-storage substance: that takes heavy metal and lots of it. The various more modern and glamorous trends in computing just have to sit and wait for the big metal to grind its way through the supporting data.

Some things you just can't sex up with random references to "quantum" or the almost meaningless "AI" tag, and it's only by a close examination of the heart of the AI beast that you can determine how benefit is here delivered or derived. Likewise, sprinkle plenty of salt on claims to be changing the world already through quantum computing. Even as we see increasing military and nation-state activity in hacking circles, that doesn't automatically imply that they have access to anything horsepower-intense or expensive.

Most of the hacks I've cleared up in the past six months have been about generating what look like convincing Western consumer identities, for immediate resale to credulous, broke and frequently desperate non-Westerners. There's not a single quantum attribute in that whole pyramid selling scheme, which relies upon the promise of jam tomorrow while encouraging the natives to come across with real cash today for those validated Western identities.

Again: no quanta were harmed in the making of that hacker economy.

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The screenshot shows a news article from Thales' website. The headline reads: "THALES AND QUANTINUUM LAUNCH STARTER KIT TO HELP ENTERPRISES PREPARE FOR POST-QUANTUM CRYPTOGRAPHY". Below the headline, there are three icons: a double-headed arrow, a lightbulb, and a gear. At the bottom of the article, there is a note: "The new solution - the PQC Starter Kit - offers a quick and easy way for users to test and measure their post-quantum readiness for protection against quantum computing attacks." Another note below that says: "Crypto agility and preparedness for the post-quantum era are essential to mitigate the risk of data breaches once quantum

RETRO

Inspirational stories from computing's long-distant past



Bumpy ride: the SAM Coupé story

With one foot in the past and one eye on the future, the SAM Coupé may yet go down in history as a legendary computer.

David Crookes uncovers its story

My friend had a SAM Coupé. He bought it in the early 1990s from a shop called Micro-Tech somewhere north of Manchester, having been convinced it was the Next Big Thing by a computer salesman wearing a long, brown lab coat like Ronnie Barker in *Open All Hours*. But my friend seemed happy. "Prince of Persia," he would say, nodding. "Prince. Of. Persia."

The fact that the game to which he was referring had been released on pretty much every platform under the sun mattered not one jot to him. Nor to any SAM Coupé owner. *Prince of Persia*, with its lifelike character animation, was trotted out as proof that this 8-bit computer was powerful

enough to stand toe-to-toe with 16-bit machines.

The game was ported to the machine by developer Chris White who, like my friend, was lured into buying a SAM Coupé. Not due to a salesman's patter, but because the computer was based on a Z80 processor: a Zilog Z80B running at 6MHz, which was a step up from the more commonly used 3.5MHz Z80A that powered the ZX Spectrum. "The SAM Coupé was, in my honest opinion, the next big thing and it was based on a processor I knew," White told *PC Pro*. "I'd started with a ZX81 computer and Z80 was my first language."



ABOVE The SAM Coupé had an unusual design and space for two 3.5in disk drives

His first task: to port the *Prince of Persia* to the platform. "I thought, 'how hard could it be?'" he admits. You can guess the answer.

"The hardest part was creating the graphics and producing the maps," he said. "I played the game over and over and over, pausing the screens and drawing them pixel by pixel on graph paper." It provided stark proof that makers of the SAM Coupé had made a successful machine. Trouble is, too few people actually found out first hand just how good it was.

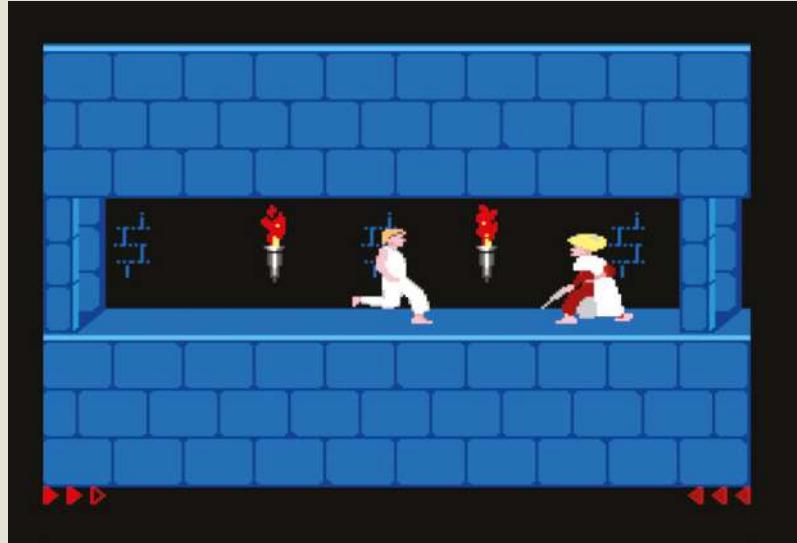
"I played the game over and over and over, pausing the screens and drawing them pixel by pixel on graph paper"

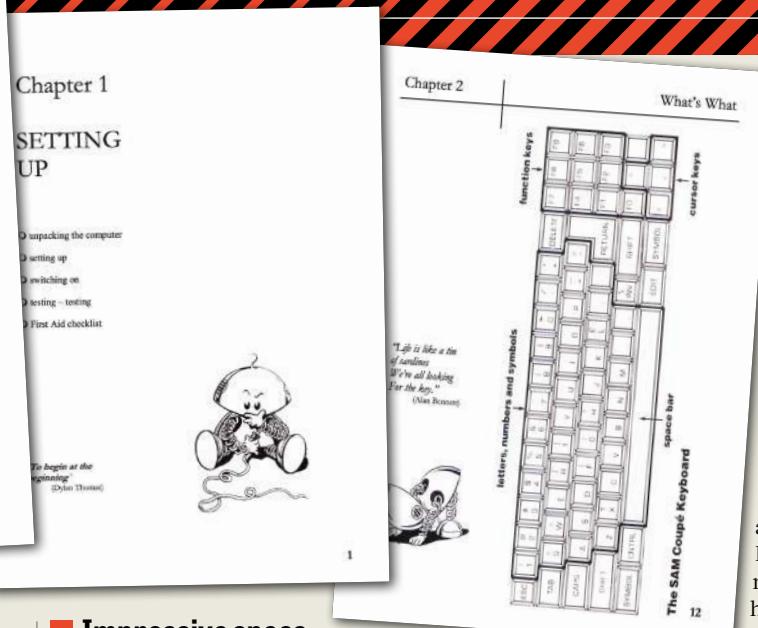
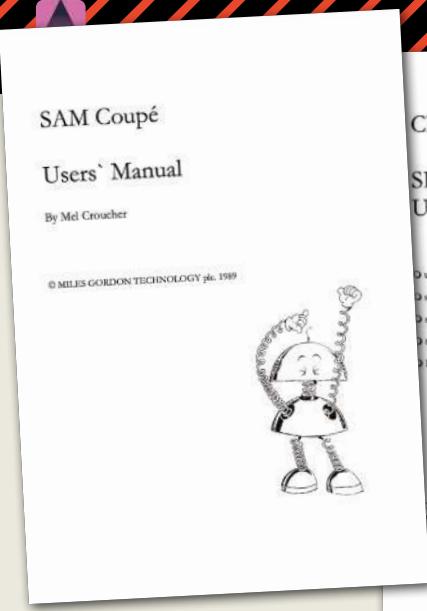
LEFT Chris White's *Prince of Persia* is still considered the SAM Coupé's best ever game

The "superclone"

Work on the SAM Coupé began shortly after Alan Miles and Bruce Gordon left Sinclair Research in 1986. Miles had been responsible for introducing the Sinclair range of computers in the Middle East, while Gordon was a hardware designer. For a spell, they created peripherals for the Speccy, including a floppy disk interface called the DISCiPLE and a successor product named D+, but they were also thinking big.

Profits from the sales of such hardware helped to fund development of what Miles and Gordon hoped would be the best 8-bit computer on the market. Operating as Miles Gordon Technology (MGT), the idea





was to build upon elements of the Spectrum, in the hope of enticing Speccy owners to upgrade.

The SAM Coupé would run Spectrum software via one of its four video modes, allowing upgraders to keep their games and utilities. Those picking up a SAM Coupé fresh would also have a healthy, ready-made back catalogue of titles to choose from.

Such an approach, however, meant that the SAM Coupé was labelled a “superclone” in magazines such as *Crash*. “There’s still some argument in the SAM world about whether the association with the Spectrum was actually helpful or not,” said Andrew Collier, creator of the worldofsam.org website. “People who had owned a Spectrum for a few years could buy the SAM and not worry that their software collection would become obsolete overnight – but it did tend to overwhelm the SAM’s reputation as a computer in its own right.”

■ Impressive specs

Given Gordon and Miles' background, however, it was natural that they'd take inspiration from their former employer. To that end, they looked to create an affordable computer: aiming for a retail price of £100, they decided to produce a core machine that could be expanded, giving users control over the power they would require.

To reduce costs, they designed a custom 10,000-gate Application Specific Integrated Circuit that worked in much the same way as the ULA in the Spectrum. It was tasked with memory paging and colour-palette allocation. They also gave the machine a standard (but upgradable) 256KB of memory, a six-channel stereo sound Philips SAA1099P chip and the capacity to make use of 16 colours from a palette of 128 with a 256 x 192 resolution.

The SAM Coupé had space for two 3.5in disk drives, included SAM's own version of BASIC, and was capable of running CP/M. It also had an unusual, eye-catching case, courtesy of Nick Holland Design in Cardiff. Rather than have the computer's 72 full-travel keys towards the front, they were placed at an angle at the rear, leaving a sizable front section on which users could rest their wrists. There were four small blue plastic legs either side of the casing and, on the back, expansion and MIDI ports as well as sockets for a light pen, tape deck, mouse and joystick.

"I always thought the hardware design was quite attractive," said Collier. "They couldn't make the

“The problem was that by 1989 quite a lot of Spectrum games were 128K-only, so the newest games didn’t work”

whole thing smaller, so it made sense to use the front part of the case as a wrist rest so you didn't have to bend your fingers so far up to reach the keyboard... In a way it was ahead of its time, the position of the keyboard is exactly what we'd now expect to see on a modern-day laptop."

A costly effort

To help users get to grips with the computer, MGT enlisted video games pioneer and legendary journalist Mel Croucher to write the manual. It took users by the hand and presumed no prior computing knowledge. It also revealed why the computer led the Coupé. "It slopes like of a racing car," Croucher But the wheels soon came off.

While its graphics modes were "at least in the same ballpark as that of the Atari ST and the Amiga," said Collier, it didn't have "enough CPU grunt to take real advantage of the graphics capability. It was faster than the Spectrum, but by less than 2x; there were no hardware sprites or blitting, so with all that screen memory even the simplest possible full-screen operation (scrolling two pixels to the left) couldn't be done at more than about 10fps. People came up with all sorts of tricks to show fluid motion without having to update so much of the screen, but it meant that certain types of game were impossible."

Delays in the production of the ASIC meant the launch slipped from April to December 1989, with only a couple of hundred machines available before Christmas. The price rose to £170 and the decision to

allow people to buy a core machine and expand it actually meant that a decent spec significantly increased the cost. Meanwhile, the price of 16-bit computers began to fall, leaving a much smaller gap.

Compatibility proved another challenge. "SAM could play most 48K Spectrum games – there were only a few that wouldn't load," said Collier. "The problem was that by 1989 quite a lot of Spectrum games were 128K-only, so the newest games didn't work, and even the ones which did were missing features like music or sound effects in their 48K versions... in most respects, playing Spectrum games on the SAM was a relatively poor experience."

Then there were buggy ROM chips that emerged in March 1990 that entailed sending out upgrades to some 8,000 existing users. It all became too



LEFT Spectrum magazines such as *Crash* followed the fortunes of the SAM Coupé

much for the company to bear and, on 11 June, MGT went into receivership.

Miles and Gordon were crestfallen yet optimistic. "We have failed as a company, but we've got a good product and we're making sure it doesn't fail too," Miles said. By 6 August, the pair had formed SAM Computers Ltd (aka SAMCo) and started selling the machine again, this time for £200 with a disk drive.

They also set up a software label called Revelation, which published *Prince of Persia*, the first major licensed game for the SAM Coupé. Revelation solved one of the other problems faced by MGT: a lack of dedicated software for its computer, since established publishers lining up new releases had become jittery and pulled back on their promises.

Although there were some great apps, such as Bo Jangeborg's art and animation package Flash, which was bundled with the machine, there were too few games. It had taken six months for the first dedicated SAM Coupé game to arrive: *Defenders of the Earth*.

Second wind

The situation began to get better. White was employed as SAMCo's in-house coder and he followed *Prince of Persia* with a port of *Lemmings* (released in 1993) while developing utilities to assist other developers. Even so, the emphasis on new rather than relying on the old wasn't entirely plain sailing, with White pointing to some missed opportunities.

"The lack of hardware sprites and scrolling were considered to be a miss and yet it would have been possible to add them to the custom ASIC," he said. "It would have delayed the computer even more but, had they been implemented, the SAM Coupé might have been able to beat the Atari 520ST."

Nevertheless, Revelation went on to publish a more colourful, expanded version of *Manic Miner* as well as *Astroball*. Meanwhile, third-party publisher Emiga Variations released *Escape From the Planet of Robot Monsters*.

"SAM came into its own when you ran its own software, and used its other graphics modes which had increased capabilities," Collier said. "In particular, SAM had more colours, a higher-resolution mode, and a mode where the colour of every pixel could be changed individually – no 'attribute squares' or 'colour clash'."

Still, SAMCo struggled as attention turned elsewhere, notably

towards the Amiga and the growing console market. The company went into receivership on 15 July 1992, before West Coast Computers swooped in and bought the stock four months later. Sales continued and a new model, the SAM élite, which had 512KB of memory as standard, was released. In total, 12,000 SAM computers were sold.

Play it again

Gradually, the small user base seized control

of the machine and its market. They lapped up games such as *Legend of Eshan* in 1994 and *T'n'T* in 1995, the latter developed using the GamesMaster creation tool. They also used notable applications such as Sound Machine, E-Tracker and SAM MOD Player.

Then talented coders such as Colin Piggot began to produce even more jaw-dropping games, including the epic *Stratosphere* and *Money Bags* (the latter is labelled as the SAM's answer to *Jet Set Willy*). And they're continuing to do so. More recently, Piggot created *IMPosters*, while the puzzler *Sploids* got a good reaction in 2021, the same year a stunning version of *Rick Dangerous* was unleashed by Anton Javorček. Adrian Brown's SAM Coupé port of the classic *Treasure Island Dizzy* is going down well, too.

Piggot is also known for producing hardware. The Quazar Surround sound card became popular for its ability to boost the quality of the computer's audio, while the Trinity Ethernet Interface connects the computer to the internet. Piggot also sells mechanical keyboards – perfect if the keyboard membrane has stopped working – as well as various internal upgrades.

Showing no end to his abilities, Piggot is also the editor of a magazine called *SAM Revival* (samcoupe.com),



ABOVE In 2021, *Rick Dangerous* was released on the SAM Coupé

which has been in print since August 2002. "The cover disc is certainly one of the great strengths of the magazine," Piggot said. "The idea originally came about when I was offered an old software title to feature as a one-off with the magazine, so the initial idea was to run with it as purely a one-off bonus. But that was quickly followed by another author offering his unreleased game to accompany the magazine, too. That cemented the decision that featuring software, both

old and new, was a brilliant way to expand the scope of the magazine."

Having secured the full rights to old SAM Coupé software from three developers, Piggot is helping to keep the

computer alive. "This also leads to the possibility of remakes/demakes to other platforms – there are some spectacular SAM games that deserve to be made available to far wider audiences to showcase what the SAM scene has to offer," he said.

One thing's for sure, it's an exciting computer to get hold of. If only getting hold of one was easy. On the rare occasions a SAM Coupé appears for sale, it's sure to sell for a high price – an empty box recently fetched £150. But that's not to say that you can't experience it. To get a flavour of what the computer has to offer, your best bet is to fire up the SimCoupé emulator for Windows, macOS and Linux at simonowen.com/simcoupe.

You can then obtain software by going to Andrew Collier's World of Sam (worldofsam.org), where you'll find an abundance of utilities, games and demos cleared for distribution.

"Hindsight is always 20/20 but, in my honest opinion, the SAM Coupé succeeded; it was a good 8-bit machine," White said. "It just failed in the mass market because it was around a year too late. By that time, the Amiga and Atari ST had gained a solid foothold and 16-bit was the next big thing."



BELLOW The free art package Flash used multimode, split-screen editing

Futures

We explore the trends and technologies that are set to shape the future



Working with robots: will it make us lazy?

Research has suggested we slack off when teamed with a robot – an effect seen with other technologies, too. Nicole Kobie reveals what's happening

Robots make us lazy. Not because Roombas are vacuuming our houses, but because humans have a habit of slacking off when sharing tasks.

That's according to recent research that had humans and robots working side by side – sort of – to inspect circuit boards. The results suggest that working within a team, robot or otherwise, can inspire and motivate, but it can also spark "social loafing" – when a team member knows their own contribution can't be discerned among the wider effort, they let others pick up the slack.

You might be thinking of that one guy at work who never pitches in, but when it comes to robots, we might be that guy.

BELOW Don't worry, we won't judge you for using a robot vacuum



But then again, isn't that how it's supposed to work? What's the point of robotics that don't make life easier? Plenty of robots are designed to replace more expensive human workers, not least because they're able to work longer hours on repetitive tasks without breaks. But robotics are also built for precision work, able to manage details deemed too fiddly for humans – or too difficult. Indeed, the very first industrial robots started work in American automotive manufacturing in 1961, with the Unimate picking parts out of diecasting machines. No-one would call those factory workers lazy for happily passing that dangerous and dirty job over to machines.

Since then, robots have slowly stepped into the workplace, with the number used globally for commercial uses tripling in the past 20 years to more than two million. Of course, that's still small compared to the number of human workers out there, and much of that robotic labour has been in manufacturing.

However, a recent shortage of workers has sparked efforts to further push robots into new industries, in particular warehousing and logistics, but improvements in artificial intelligence have some hoping robots will find roles in a wider range of work.

As that happens, we'll have to keep a careful watch over how robot helpers impact their human coworkers, and whether we'll overrely on our machine colleagues.

■ What the research says

The risk of overreliance on robots and human workers becoming lazier was revealed by research from the Technical University of Berlin. “Teamwork is a mixed blessing,” Dietlind Helene Cymek, first author of the study in *Frontiers in Robotics and AI*, said in a statement. “Working together can motivate people to perform well but it can also lead to a loss of motivation because the individual contribution is not as visible. We were interested in whether we could also find such motivational effects when the team partner is a robot.”

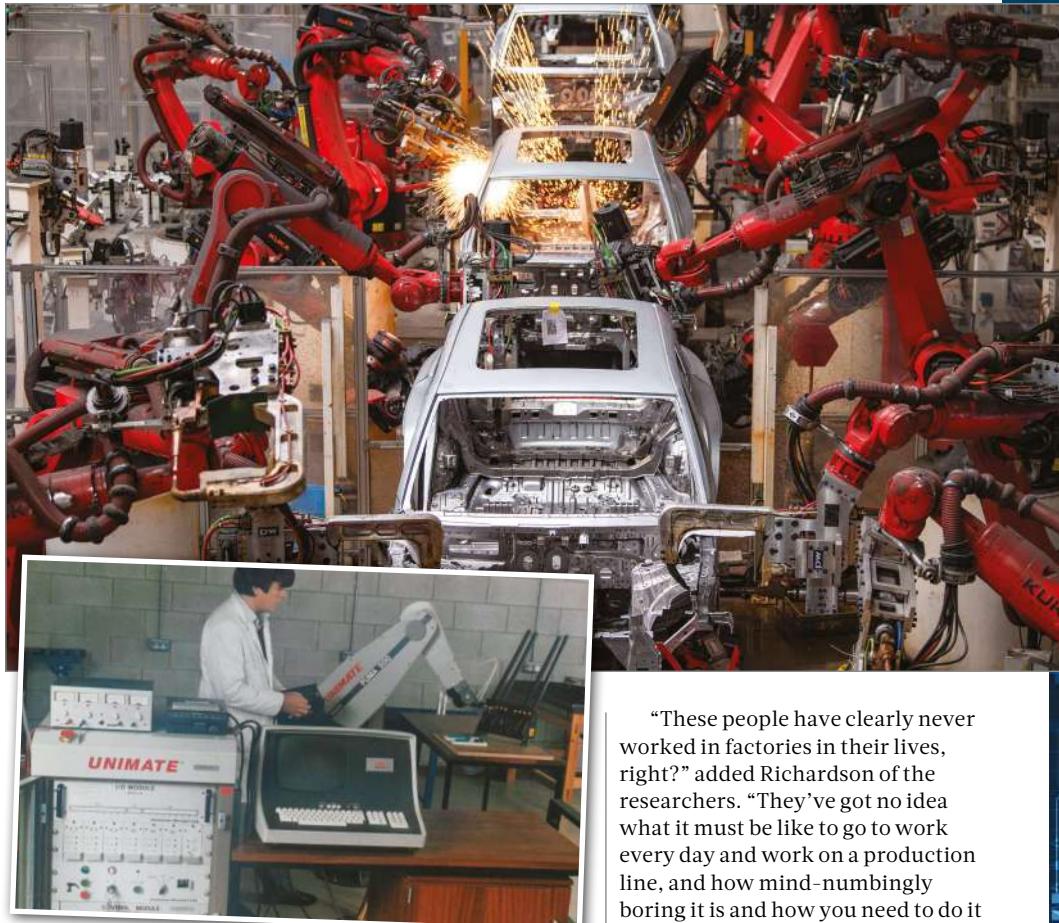
To test this idea, the researchers tasked volunteers with inspecting an image of a circuit board for errors. Some of the participants were told that the board they were looking at had already been inspected by a robot named Panda. This wasn’t true, as Panda lacks the ability to actually complete the task, but the human inspectors didn’t know that – and the researchers made sure the participants had seen the robot and heard it “working” to convince them.

There was no difference in the amount of time each group – those who did all the inspection, and those who had “help” from Panda – spent examining the boards. But it soon became clear that those who believed they were working alongside a robot were spotting fewer errors, which the researchers said could be the result of “looking but not seeing”. In other words, the robot-partnered participants were zoning out, believing their work wasn’t necessary because Panda would spot the errors.

The researchers admit it’s difficult to know exactly what was going on in each participant’s head, and the lab setting might have skewed results, as would-be social loafers know they’re being watched. Research in real-world settings would therefore be ideal, said Cymek. And if the rise of robots at work continues, we should have plenty of opportunities to do just that.

■ What's the point of robots?

When robots operate alongside people, an idea sometimes referred to as collaborative robots or “cobots”, the aim is to lighten the workload. Perhaps robots take on difficult jobs – as with the Unimate and diecasting in American car factories 60 years ago – or handle repetitive work that would bore or physically stress a human worker. But that’s not always the case: Amazon has been criticised for requiring human staff to do repetitive roles quickly without breaks so they can keep pace with robot helpers. (The humans and



robots are working side by side because robots can't do all of the tasks required... yet.)

Part of the challenge comes down to the motivation behind using robots. No-one complains that Roomba owners are lazy for failing to vacuum the floors themselves; robotic vacuums are a clever way to avoid certain chores, just the same as a dishwasher or a fridge save labour for homemakers.

And that’s one reason why Kathleen Richardson, professor of ethics and culture of robots and AI at de Montfort University in Leicester, is so critical of the robot-sparked laziness research. In short: shouldn’t robots make work nicer, easier or better? “It sounds reasonable that maybe somebody goes into work every day and believe the computers are going to find the problems and we’ll do less work – that seems an entirely reasonable thing,” she said.

ABOVE Robots have been common in manufacturing for many decades

“These people have got no idea what it must be like to go to work every day and work on a production line, and how boring it is”

“These people have clearly never worked in factories in their lives, right?” added Richardson of the researchers. “They’ve got no idea what it must be like to go to work every day and work on a production line, and how mind-numbingly boring it is and how you need to do it in order to pay bills. I think they come at it from a managerial approach.” In other words, they’re concerned about the benefits of robots in the workplace, but not the potential beneficial impacts for workers.

■ Beware robot limitations

But take a step back and Richardson says the research is revealing in other ways. For example, the robot wasn’t capable of the work it was pretending to do. The human test subjects believed it was, and some of them leaned on

it, believing the robot would act as a safety net. This idea of overreliance on technology perceived to be smart isn’t new, but it is important.

There are lots of stories of drivers letting satnav systems direct them into dangerous or foolish situations. That also holds true with autonomous cars, as research suggests many of us are happy to pass off driving to AI systems, even when we’re told we need to continue to pay attention and keep our hands on the wheel. (Tesla’s Autopilot requires hands-on driving, but plenty of people post videos of themselves not paying attention, despite multiple accidents.)

With this robot research, the human test subjects believed their coworkers were reliable, but that



BELLOW Tesla drivers are meant to hold on to the steering wheel, but do they really?

wasn't true. This suggests that human workers need to be fully aware of the limitations of robots when such machines are eventually introduced to workplaces, and – as the researchers themselves said – further studies in real settings would reveal other concerns and mitigations needed as robots step into new roles.

The research is also intriguing as it picks up on how workers might integrate robotics into their working lives. And that begins with the human tendency to anthropomorphise machinery, smart or otherwise; anyone who's ever named a stapler will recognise this habit. While we may criticise treating robots like humans – perhaps giving them faces to seem friendly or naming them – this is the only way many of us have to mediate our understanding with these tools, says Richardson.

"It seemed like the researchers were interested in finding out something that was not really about the workers' experience, they were interested in this co-experience – but it's not even a co-experience. I'm not having a co-experience with my computer," she added.

Cobots today

ABB Group makes cobots, launching the Umi in 2015, and so has a good sense of how human coworkers interact with their products. By cobots, the Swedish-Swiss company doesn't just mean robots that people work alongside, but robots that human workers can actively interact with, such as programming their actions by physically moving their arms and so on.

"The idea is that this robot should be friendly, and have safety functions built in so it can work alongside humans," said Andie Zhang, global product manager for ABB's Collaborative Robots division, noting that the cobots don't require external fencing for safety. "The industrial design is very important to make the humans feel comfortable standing next to the robot, aside from safety functions we went to great lengths for our cobots to have a friendly and intuitive design."

The robots are used in a wide range of roles, from manufacturing to logistics and medical labs. "Typical applications can be lifting parts, moving things from one area to another, such as picking up a block of metal or plastic and putting it inside a machine, and when the part is finished, the robot picks it up and takes it out," she said. "Another typical application is palletising at the end of line, putting products in boxes and stacking boxes on top of each other."



ABOVE Humans are often required to supervise robot work

The humans that work alongside the cobots decide what they do. "The robot will not do anything that is not pre-programmed or determined by humans," she said.

And, typically, they don't work in sequence or depend on each other – the robot has a job to get on with, as do humans. "We don't want them to be dependent on each other, like the robot handing something to the human but the human is doing something else, so the robot is left waiting," she clarified.

Instead, a robot would be perhaps manufacturing a part, while the human might inspect for quality, move the finished goods or supply new materials. "It's more like supervising," Zhang said. "But they will be working in this common shared workspace."

■ Robots can't replace us yet

The introduction of cobots or robots can cause concern in a workplace about job losses, Zhang admits. She points out a key fact that many miss when discussing job losses: so far, robots can't replace humans. "They're collaborating because the robot can't do it all from the beginning to the end of the entire process," she said.

Still, managers should acknowledge those concerns when introducing robots to a process, explaining their purpose beforehand – perhaps it's taking on a role that's difficult to hire to fill, the aim is to boost productivity, or to take on difficult or dangerous jobs. "People feel relieved that the robot can do the toughest, most repetitive, boring jobs," said Zhang. "Whereas humans... learn

to operate automation, which is upskilling for them."

And from ABB's experience, letting human employees interact with robots is key to using them successfully. Employees should not only get a chance to try programming their coworkers – which can be as simple as tapping a button, moving an arm into position, and so on – but also to try stopping the robot with their hands, achieved by simply touching

it. "It's important that before the robots are put to work that the workers around the robot experience what it's like to both move the robot around to start the programme and also

experience what it's like to safely stop the robot with their hand," she said. "This way they feel comfortable and know that they're in control."

"The point of a robot is it's a tool, and it's supposed to improve our work," she added. "You're not meant to give it the same task as a human." The researchers were testing a circumstance that wouldn't happen in a real setting, she notes.

And though we may get lazy with driving directions when using satnav, Zhang wonders if that's really such a bad thing? "We can get from A to B in a more effective, efficient way," she said. "And we can focus on thinking about using our mind for other things."

That's how it should be with robots, she argues. The robot should do the boring, repetitive tasks, and the human should be given better work. And there's nothing lazy about that. ●

"The point of a robot is it's a tool, and it's supposed to improve our work. You're not meant to give it the same task as a human"

BELOW Amazon has been criticised for requiring humans to keep pace with robots





Next month

ON SALE

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Features



AI PCs: what they can actually do

AMD, Intel and Microsoft have hyped the AI PC concept to a crescendo, but what difference does having NPUs genuinely make today?

Features



Has your network been hacked?

Today's cybercriminals have learnt to fly under the radar. We show you how to find hidden threats before they strike.

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Master the Pi VPN

Securely access your home network from anywhere, using secure, industry-standard VPN protocols – all you need is a Raspberry Pi!

Labs

Chromebook Plus laptops

Google promises that its Chromebook Plus laptops offer double the speed and capabilities of a typical Chromebook. We put all the best official (and unofficial) models to the test.



Retro



Rise of the retro handheld consoles

Want to play classic games on the move? We pitch the new ZX Spectrum Touch head to head with the much-praised Anbernic RG35XXH.

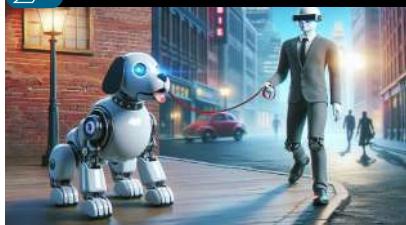
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Futures



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When technology glosses over reality, says Jon Honeyball, we put history at risk

I have been incredibly lucky in my life with the people I've met. The list of names is too long, and I'm sure I impacted their lives infinitely less than they influenced mine. Jobs, Gates, Wolfram, Allchin, Silverberg: the list is long.

The same is true for musicians. Having a classical pianist background, I was fortunate to study with Curcio, Boulez, Kondashin, Dutoit and Groves. And to meet on recording sessions with Ashkenazy, Marriner and many more.

They say you should never meet your heroes, but they are wrong. No-one is perfect, but each of these people had a spark, a passion and a genius that showed you why they had succeeded in their chosen field.

In the early 1980s, the One True Goddess was Joni Mitchell. The words "voice of an angel" wouldn't even begin to describe the talent of this lady. Every album, every song is there to be savoured time after time. Her career spans so many decades, over various genres, that dropping in on a random playlist of her back catalogue never becomes boring. The next song is always a treat, a delight that can make your heart soar and plummet to the depths.

I wasn't alone among my university friends in my worship of Joni, and I clearly remember a small group of us working on Ken's ancient and tired Morris Minor. We were listening to Capital Radio and heard that there was to be a special recording of conversations with Joni the next day in central London. The car was reassembled at record speed, and we drove up the A3 to buy tickets. Then returned the next day for the event, where we sat in the front row, entranced to be in the presence of Joni herself. It's there on her website, and I recommend you head to tinyurl.com/355joni so you too can enjoy it.

Joni is now 80 and hasn't been well, suffering a brain aneurysm. Recovery has been slow, but she shocked the 2022 Newport Folk Festival where she sang in public for the first time in 20 years. Again, it's there for all to see at tinyurl.com/355newport. It didn't matter that she was frail and relying on the support of her fellow musicians. She was there, in person, a sight I feared I would never see again.

She had just received a Grammy award and gave a performance to mark the moment. The fire was there, if the intonation was a little rocky in places. But any imperfections from the original performances decades ago were irrelevant – it was Joni, and she was singing. It was a moment of reality and humanity. And no sign of the dreaded lip-sync beloved of lesser artists, who rightly find it embarrassing when the unreleased live mic version gets leaked to the public.

Of course, we not only have the library of Joni's recorded material, but the internet affords us video material, too. This is a critically important record for posterity. People will be listening to Joni when we have colonies on Mars. Or when we finally get to the Gamma Quadrant.

Which is why I am extraordinarily angry and disappointed to read that the Superbowl half-time concert has been doctored. Alicia Keys was singing and, on one note, her voice had a little wobble. A tiny, insignificant nothing. Indeed, something to be treasured, showing that she was actually singing live in front of a global audience. A moment of reality and humanity.

On the official NFL YouTube channel, posted some hours after the event, the wobble had gone.

Now autotune is a well-known tool, made famous in its overdriven state by Cher. There are phenomenal tools that allow you to edit a recording – taking out the hum of an air-conditioning plant, or a truck driving past the hall in the middle of a take. These are all parts of the toolset of a recording engineer, and essential when the clock is ticking on a session. A top flight orchestra costs tens of thousands of pounds per day. Hiring a world-class studio, with staff, can run into multiple thousands of pounds. Doing a retake because a police car drives past with its siren wailing isn't affordable.

"It's a very different thing to take a live performance and adjust it. This sort of modification of a live transmission means that trust is eroded even further"

But it's a very different thing to take a live performance and adjust it. Perhaps Alicia Keys is unaware of the change, and maybe it's just her team "protecting her digital legacy". But it doesn't sit right with me, and this sort of shameless modification of a live transmission means that trust is eroded even further.

Compare and contrast to Joni's recent performances. She has an integrity and honesty, and we love her all the more for it. The idea of trying to touch up her singing makes my skin crawl, and hopefully hers, too.

But then again, one of these ladies is a musical goddess. The other – to my mind at least – a product of the entertainment industry. Why am I surprised at the outcome?

■ Jon Honeyball is a contributing editor to PC Pro. He really doesn't know clouds at all. Email jon@jonhoneyball.com



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